



SEQUENCE LISTING

<110> Bell, John C.  
Sonenberg, Nahum  
Stojdl, David F.  
Brown, Earl G.  
Atkins, Harold L.  
Marius, Ricardo M.  
Lichty, Brian D.  
Knowles, Shane B.

<120> ONCOLYTIC VIRUS

<130> 18003-D2

<140> US 10/743,649

<141> 2003-12-22

<150> US 09/664,444

<151> 2000-09-18

<150> 60/287,590

<151> 1999-09-17

<160> 52

<170> PatentIn Ver. 2.1

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<210> 7  
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<212> PRT  
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<210> 9  
<211> 1269  
<212> DNA  
<213> Vesicular stomatitis virus

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acaatcggaa tatttgacct tgtatccttg aaagccctgg acggcgact tccagatgga 360  
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<210> 10

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<212> DNA

<213> Vesicular stomatitis virus

<400> 10

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<210> 11

<211> 1269

<212> DNA

<213> Vesicular stomatitis virus

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cggggtaagt tggataaaga ttgggtcaagt ttcggaataa acatcgggaa ggcaggggat 300
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 <212> DNA  
 <213> Vesicular stomatitis virus

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 acaaatacat gcaaaatgat caatgaacag tttgaacctc ttgtgccaga aggtcgtgac 540  
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 gacaaatga 1269

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 <211> 1029  
 <212> DNA  
 <213> Vesicular stomatitis virus

<220>  
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 <222> (1)..(1029)  
 <223> "n" represents a, t, c, g, other or unknown

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 aaaatgatca atgaacagtt tgaacctctt gtgccagaag gtcgtgacat ttttgatgtg 360  
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 ttcaaaaaac atgaatgtgc ctcgttcaga tacggaacta ttgtttccag attcaaagat 480  
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 gacaaatga 1029

<210> 14  
 <211> 422  
 <212> PRT  
 <213> Vesicular stomatitis virus

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 Arg Lys Ser Lys Glu Ile Pro Leu Tyr Ile Asn Thr Thr Lys Ser Leu  
 35 40 45  
 Ser Asp Leu Arg Gly Tyr Val Tyr Gln Gly Leu Lys Ser Gly Asn Val  
 50 55 60  
 Ser Ile Ile His Val Asn Ser Tyr Leu Tyr Gly Ala Leu Lys Asp Ile  
 65 70 75 80  
 Arg Gly Lys Leu Asp Lys Asp Trp Ser Ser Phe Gly Ile Asn Ile Gly  
 85 90 95  
 Lys Ala Gly Asp Thr Ile Gly Ile Phe Asp Leu Val Ser Leu Lys Ala  
 100 105 110  
 Leu Asp Gly Val Leu Pro Asp Gly Val Ser Asp Ala Ser Arg Thr Ser  
 115 120 125  
 Ala Asp Asp Lys Trp Leu Pro Leu Tyr Leu Leu Gly Leu Tyr Arg Val  
 130 135 140  
 Gly Arg Thr Gln Met Pro Glu Tyr Arg Lys Lys Leu Met Asp Gly Leu  
 145 150 155 160  
 Thr Asn Gln Cys Lys Met Ile Asn Glu Gln Phe Glu Pro Leu Val Pro  
 165 170 175  
 Glu Gly Arg Asp Ile Phe Asp Val Trp Gly Asn Asp Ser Asn Tyr Thr  
 180 185 190  
 Lys Ile Val Ala Ala Val Asp Met Phe Phe His Met Phe Lys Lys His  
 195 200 205  
 Glu Cys Ala Ser Phe Arg Tyr Gly Thr Ile Val Ser Arg Phe Lys Asp  
 210 215 220  
 Cys Ala Ala Leu Ala Thr Phe Gly His Leu Cys Lys Ile Thr Gly Met  
 225 230 235 240

Ser Thr Glu Asp Val Thr Thr Trp Ile Leu Asn Arg Glu Val Ala Asp  
245 250 255

Glu Met Val Gln Met Met Leu Pro Gly Gln Glu Ile Asp Lys Ala Asp  
260 265 270

Ser Tyr Met Pro Tyr Leu Ile Asp Phe Gly Leu Ser Ser Lys Ser Pro  
275 280 285

Tyr Ser Ser Val Lys Asn Pro Ala Phe His Phe Trp Gly Gln Leu Thr  
290 295 300

Ala Leu Leu Leu Arg Ser Thr Arg Ala Arg Asn Ala Arg Gln Pro Asp  
305 310 315 320

Asp Ile Glu Tyr Thr Ser Leu Thr Thr Ala Gly Leu Leu Tyr Ala Tyr  
325 330 335

Ala Val Gly Ser Ser Ala Asp Leu Ala Gln Gln Phe Cys Val Gly Asp  
340 345 350

Asn Lys Tyr Thr Pro Asp Asp Ser Thr Gly Gly Leu Thr Thr Asn Ala  
355 360 365

Pro Pro Gln Gly Arg Asp Val Val Glu Trp Leu Gly Trp Phe Glu Asp  
370 375 380

Gln Asn Arg Lys Pro Thr Pro Asp Met Met Gln Tyr Ala Lys Arg Ala  
385 390 395 400

Val Met Ser Leu Gln Gly Leu Arg Glu Lys Thr Ile Gly Lys Tyr Ala  
405 410 415

Lys Ser Glu Phe Asp Lys  
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<210> 15

<211> 422

<212> PRT

<213> Vesicular stomatitis virus

<400> 15

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20 25 30

Arg Lys Ser Lys Glu Ile Pro Leu Tyr Ile Asn Thr Thr Lys Ser Leu  
35 40 45

Ser Asp Leu Arg Gly Tyr Val Tyr Gln Gly Leu Lys Ser Gly Asn Val  
50 55 60

Ser Ile Ile His Val Asn Ser Tyr Leu Tyr Gly Ala Leu Lys Asp Ile  
65 70 75 80

Arg Gly Lys Leu Asp Lys Asp Trp Ser Ser Phe Gly Ile Asn Ile Gly  
85 90 95

Lys Ala Gly Asp Thr Ile Gly Ile Phe Asp Leu Val Ser Leu Lys Ala  
100 105 110

Leu Asp Gly Val Leu Pro Asp Gly Val Ser Asp Ala Ser Arg Thr Ser  
115 120 125

Ala Asp Asp Lys Trp Leu Pro Leu Tyr Leu Leu Gly Leu Tyr Arg Val  
130 135 140

Gly Arg Thr Gln Met Pro Glu Tyr Arg Lys Arg Leu Met Asp Gly Leu  
145 150 155 160

Thr Asn Gln Cys Lys Met Ile Asn Glu Gln Phe Glu Pro Leu Val Pro  
165 170 175

Glu Gly Arg Asp Ile Phe Asp Val Trp Gly Asn Asp Ser Asn Tyr Thr  
180 185 190

Lys Ile Val Ala Ala Val Asp Met Phe Phe His Met Phe Lys Lys His  
195 200 205

Glu Cys Ala Ser Phe Arg Tyr Gly Thr Ile Val Ser Arg Phe Lys Asp  
210 215 220

Cys Ala Ala Leu Ala Thr Phe Gly His Leu Cys Lys Ile Thr Gly Met  
225 230 235 240

Ser Thr Glu Asp Val Thr Thr Trp Ile Leu Asn Arg Glu Val Ala Asp  
245 250 255

Glu Met Val Gln Met Met Leu Pro Gly Gln Glu Ile Asp Lys Ala Asp  
260 265 270

Ser Tyr Met Pro Tyr Leu Ile Asp Phe Gly Leu Ser Ser Lys Ser Pro  
275 280 285

Tyr Ser Ser Val Lys Asn Pro Ala Phe His Phe Trp Gly Gln Leu Thr  
290 295 300

Ala Leu Leu Leu Arg Ser Thr Arg Ala Arg Asn Ala Arg Gln Pro Asp  
305 310 315 320

Asp Ile Glu Tyr Thr Ser Leu Thr Thr Ala Gly Leu Leu Tyr Ala Tyr  
325 330 335

Ala Val Gly Ser Ser Ala Asp Leu Ala Gln Gln Phe Cys Val Gly Asp  
340 345 350

Ser Lys Tyr Thr Pro Asp Asp Ser Thr Gly Gly Leu Thr Thr Asn Ala  
355 360 365

Pro Pro Gln Gly Arg Asp Val Val Glu Trp Leu Gly Trp Phe Glu Asp  
370 375 380



Gln Asn Arg Lys Pro Thr Pro Asp Met Met Gln Tyr Ala Lys Arg Ala  
385 390 395 400

Val Met Ser Leu Gln Gly Leu Arg Glu Lys Thr Ile Gly Lys Tyr Ala  
405 410 415

Lys Ser Glu Phe Asp Lys  
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<210> 16

<211> 422

<212> PRT

<213> Vesicular stomatitis virus

<400> 16

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20 25 30

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35 40 45

Ser Asp Leu Arg Gly Tyr Val Tyr Gln Gly Leu Lys Ser Gly Asn Val  
50 55 60

Ser Ile Ile His Val Asn Ser Tyr Leu Tyr Gly Ala Leu Lys Asp Ile  
65 70 75 80

Arg Gly Lys Leu Asp Lys Asp Trp Ser Ser Phe Gly Ile Asn Ile Gly  
85 90 95

Lys Ala Gly Asp Thr Ile Gly Ile Phe Asp Leu Val Ser Leu Lys Ala  
100 105 110

Leu Asp Gly Val Leu Pro Asp Gly Val Ser Asp Ala Ser Arg Thr Ser  
115 120 125

Ala Asp Asp Lys Trp Leu Pro Leu Tyr Leu Leu Gly Leu Tyr Arg Val  
130 135 140

Gly Arg Thr Gln Met Pro Glu Tyr Arg Lys Arg Leu Met Asp Gly Leu  
145 150 155 160

Thr Asn Gln Cys Lys Met Ile Asn Glu Gln Phe Glu Pro Leu Val Pro  
165 170 175

Glu Gly Arg Asp Ile Phe Asp Val Trp Gly Asn Asp Ser Asn Tyr Thr  
180 185 190

Lys Ile Val Ala Ala Val Asp Met Phe Phe His Met Phe Lys Lys His  
195 200 205

Glu Cys Ala Ser Phe Arg Tyr Gly Thr Ile Val Ser Arg Phe Lys Asp

210                      215                      220  
 Cys Ala Ala Leu Ala Thr Phe Gly His Leu Cys Lys Ile Thr Gly Met  
 225                      230                      235                      240  
 Ser Thr Glu Asp Val Thr Thr Trp Ile Leu Asn Arg Glu Val Ala Asp  
                     245                      250                      255  
 Glu Met Val Gln Met Met Leu Pro Gly Gln Glu Ile Asp Lys Ala Asp  
                     260                      265                      270  
 Ser Tyr Met Pro Tyr Leu Ile Asp Phe Gly Leu Ser Ser Lys Ser Pro  
                     275                      280                      285  
 Tyr Ser Ser Val Lys Asn Pro Ala Phe His Phe Trp Gly Gln Leu Thr  
                     290                      295                      300  
 Ala Leu Leu Leu Arg Ser Thr Arg Ala Arg Asn Ala Arg Gln Pro Asp  
 305                      310                      315                      320  
 Asp Ile Glu Tyr Thr Ser Leu Thr Thr Ala Gly Leu Leu Tyr Ala Tyr  
                     325                      330                      335  
 Ala Val Gly Ser Ser Ala Asp Leu Ala Gln Gln Phe Cys Val Gly Asp  
                     340                      345                      350  
 Ser Lys Tyr Thr Pro Asp Asp Ser Thr Gly Gly Leu Thr Thr Asn Ala  
                     355                      360                      365  
 Pro Pro Gln Gly Arg Asp Val Val Glu Trp Leu Gly Trp Phe Glu Asp  
                     370                      375                      380  
 Gln Asn Arg Lys Pro Thr Pro Asp Met Met Gln Tyr Ala Lys Arg Ala  
 385                      390                      395                      400  
 Val Met Ser Leu Gln Gly Leu Arg Glu Lys Thr Ile Gly Lys Tyr Ala  
                     405                      410                      415  
 Lys Ser Glu Phe Asp Lys  
                     420

<210> 17  
 <211> 342  
 <212> PRT  
 <213> Vesicular stomatitis virus

<220>  
 <221> MOD\_RES  
 <222> (1)..(342)  
 <223> "Xaa" represents any, other or unknown amino acid

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20

25

30

Lys Ala Gly Asp Thr Ile Gly Ile Phe Asp Leu Val Ser Leu Lys Ala  
 35 40 45

Leu Asp Gly Val Leu Pro Asp Gly Val Ser Asp Ala Ser Arg Thr Ser  
 50 55 60

Ala Asp Asp Lys Trp Leu Pro Leu Tyr Leu Leu Gly Leu Tyr Arg Val  
 65 70 75 80

Gly Arg Thr Gln Met Pro Glu Tyr Arg Lys Arg Leu Met Asp Gly Leu  
 85 90 95

Thr Asn Gln Cys Lys Met Ile Asn Glu Gln Phe Glu Pro Leu Val Pro  
 100 105 110

Glu Gly Arg Asp Ile Phe Asp Val Trp Gly Asn Asp Ser Asn Tyr Thr  
 115 120 125

Lys Ile Val Ala Ala Val Asp Met Phe Phe His Met Phe Lys Lys His  
 130 135 140

Glu Cys Ala Ser Phe Arg Tyr Gly Thr Ile Val Ser Arg Phe Lys Asp  
 145 150 155 160

Cys Ala Ala Leu Ala Thr Phe Gly His Leu Cys Lys Ile Thr Gly Met  
 165 170 175

Ser Thr Glu Asp Val Thr Thr Trp Ile Leu Asn Arg Glu Val Ala Asp  
 180 185 190

Glu Met Val Gln Met Met Leu Pro Gly Gln Glu Ile Asp Lys Ala Asp  
 195 200 205

Ser Tyr Met Pro Tyr Leu Ile Asp Phe Gly Leu Ser Ser Lys Ser Pro  
 210 215 220

Tyr Ser Ser Val Lys Asn Pro Ala Phe His Phe Trp Gly Gln Leu Thr  
 225 230 235 240

Asp Ile Glu Tyr Thr Ser Xaa Thr Thr Ala Gly Leu Leu Tyr Ala Tyr  
 245 250 255

Ala Val Gly Ser Ser Ala Asp Leu Ala Xaa Gln Phe Cys Val Gly Asp  
 260 265 270

Ser Lys Tyr Thr Pro Asp Asp Ser Thr Gly Gly Leu Thr Thr Asn Ala  
 275 280 285

Pro Pro Gln Gly Arg Asp Val Val Glu Trp Leu Gly Trp Phe Glu Asp  
 290 295 300

Gln Asn Arg Lys Pro Thr Pro Asp Met Met Gln Tyr Ala Lys Arg Ala  
 305 310 315 320

Val Met Ser Leu Gln Gly Leu Arg Glu Lys Thr Ile Gly Lys Tyr Ala

Lys Ser Glu Phe Asp Lys  
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<210> 18

<211> 798

<212> DNA

<213> Vesicular stomatitis virus

<400> 18

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gacacagaat ctgaaccaga aattgaagac aatcaagggt tgtatgcaca ggatccagaa 240
gctgagcaag ttgaaggctt tatacagggg cctttagatg actatgcaga tgaggaagtg 300
gatgttgtat ttacttcgga ctggaaacca cctgagcttg aatctgacga gcatggaaaag 360
accttacggt tgacatcgcc agagggttta agtggagagc agaaatccca gtggctttcg 420
acgattaaag cagtcgtgca aagtgccaaa tactggaatc tggcagagtg cacatttgaa 480
gcatcgggag aaggggtcat tatgaaggag cgccagataa ctccggatgt atataaggtc 540
actccagtga tgaacacaca tccgtcccaa tcagaagcag tatcagatgt ttggtctctc 600
tcaaagacat ccatgacttt ccaacccaag aaagcaagtc ttcagcctct caccatatcc 660
ttggatgaat tgttctcatc tagaggagag ttcatctctg tcggagggtga cggacgaatg 720
tctcataaag aggccatcct gctcggcctg agatacaaaa agttgtacaa tcaggcgaga 780
gtcaaatatt ctctgtag 798
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<210> 19

<211> 798

<212> DNA

<213> Vesicular stomatitis virus

<400> 19

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atggataatc tcacaaaagt tcgtgagtat ctcaagtcct attctcgtct agatcaggcg 60
gtaggagaga tagatgagat cgaagcacia cgagctgaaa agtccaatta tgagttgttc 120
caagaggacg gagtggaga gcatactagg ccctcttatt ttcaggcagc agatgattct 180
gacacagaat ctgaaccaga aattgaagac aatcaaggct tgtatgtacc agatccggaa 240
gctgagcaag ttgaaggctt tatacagggg cctttagatg actatgcgga tgaggacgtg 300
gatgttgtat tcacttcgga ctggaaacag cctgagcttg aatccgacga gcatggaaaag 360
accttacggt tgacattgcc agagggttta agtggagagc agaaatccca gtggcttttg 420
acgattaaag cagtcgttca aagtgccaaa cactggaatc tggcagagtg cacatttgaa 480
gcatcgggag aaggggtcat cataaaaaag cgccagataa ctccggatgt atataaggtc 540
actccagtga tgaacacaca tccgtcccaa tcagaagccg tatcagatgt ttggtctctc 600
tcaaagacat ccatgacttt ccaacccaag aaagcaagtc ttcagcctct caccatatcc 660
ttggatgaat tgttctcatc tagaggagaa ttcatctctg tcggagggtga cggacgaatg 720
tctcataaag aggccatcct gctcggctctg aggtacaaaa agttgtacaa tcaggcgaga 780
gtcaaatatt ctctgtag 798
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<210> 20

<211> 570

<212> DNA

<213> Vesicular stomatitis virus

<400> 20

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atggataatc tcacaaaagt tcgtgagtat ctcaagtcct attctcgtct agatcaggcg 60
```

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gtaggagaga tagatgagat cgaagcacaa cgagctgaaa agtccaatta tgagttgttc 120
caagaggacg gagtggaaga gcatactagg cctctttatt ttcaggcagc agatgattct 180
gacacagaat ctgaaccaga aattgaagac aatcaaggct tgtatgtacc agatccggaa 240
gctgagcaag ttgaaggctt tatacagggg ccttttagatg actatgcgga tgaggacgtg 300
gatgttgtat tcacttcgga ctggaaacag cctgagcttg aatccgacga gcatggaaag 360
accttacggt tgacattgcc agagggttta agtggagagc agaaatccca gtggcttttg 420
acgattaaag cagtcgttca aagtgccaaa cactggaatc tggcagagtg cacatttgaa 480
gcatcgggag aaggggtcat cataaaaaag cgccagataa ctccggatgt atataaggtc 540
actccagtga tgaacacaca tccgtcccaa 570

```

<210> 21  
 <211> 798  
 <212> DNA  
 <213> Vesicular stomatitis virus

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<400> 21
atggataatc tcacaaaagt tcgtgagtat ctcaagtcct attctcgtct agatcaggcg 60
gtaggagaga tagatgagat cgaagcacaa cgagctgaaa agtccaatta tgagttgttc 120
caagaggacg gagtggaaga gcatactagg cctctttatt ttcaggcagc agatgattct 180
gacacagaat ctgaaccaga aattgaagac aatcaaggct tgtatgtacc agatccggaa 240
gctgagcaag ttgaaggctt tatacagggg ccttttagatg actatgcgga tgaggacgtg 300
gatgttgtat tcacttcgga ctggaaacag cctgagcttg aatccgacga gcatggaaag 360
accttacggt tgacattgcc agagggttta agtggagagc agaaatccca gtggcttttg 420
acgattaaag cagtcgttca aagtgccaaa cactggaatc tggcagagtg cacatttgaa 480
gcatcgggag aaggggtcat cataaaaaag cgccagataa ctccggatgt atataaggtc 540
actccagtga tgaacacaca tccgtcccaa tcggaagccg tatcagatgt ttggtctctc 600
tcaaagacat ccatgacttt ccaacccaag aaagcaagtc ttcagcctct caccatatcc 660
ttggatgaat tgttctcatc tagaggagaa ttcattctctg tcggaggtaa cggacgaatg 720
tctcataaag aggccatcct gctcggctctg aggtacaaaa agttgtacaa tcaggcgaga 780
gtcaaatatt ctctgtag 798

```

<210> 22  
 <211> 798  
 <212> DNA  
 <213> Vesicular stomatitis virus

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<400> 22
atggataatc tcacaaaagt tcgtgagtat ctcaagtcct attctcgtct agatcaggcg 60
gtaggagaga tagatgagat cgaagcacaa cgagctgaaa agtccaatta tgagttgttc 120
caagaggacg gagtggaaga gcatactagg cctctttatt ttcaggcagc agatgattct 180
gacacagaat ctgaaccaga aattgaagac aatcaaggct tgtatgtacc agatccggaa 240
gctgagcaag ttgaaggctt tatacagggg ccttttagatg actatgcgga tgaggacgtg 300
gatgttgtat tcacttcgga ctggaaacag cctgagcttg aatccgacga gcatggaaag 360
accttacggt tgacattgcc agagggttta agtggagagc agaaatccca gtggcttttg 420
acgattaaag cagtcgttca aagtgccaaa cactggaatc tggcagagtg cacatttgaa 480
gcatcgggag aaggggtcat cataaaaaag cgccagataa ctccggatgt atataaggtc 540
actccagtga tgaacacaca tccgtcccaa tcagaagccg tatcagatgt ttggtctctc 600
tcaaagacat ccatgacttt ccaacccaag aaagcaagtc ttcagcctct caccatatcc 660
ttggatgaat tgttctcatc tagaggagaa ttcattctctg tcggaggtaa cggacgaatg 720
tctcataaag aggccatcct gctcggctctg aggtacaaaa agttgtacaa tcaggcgaga 780
gtcaaatatt ctctgtag 798

```

<210> 23  
 <211> 265

<212> PRT

<213> Vesicular stomatitis virus

<400> 23

Met Asp Asn Leu Thr Lys Val Arg Glu Tyr Leu Lys Ser Tyr Ser Arg  
1 5 10 15

Leu Asp Gln Ala Val Gly Glu Ile Asp Glu Ile Glu Ala Gln Arg Ala  
20 25 30

Glu Lys Ser Asn Tyr Glu Leu Phe Gln Glu Asp Gly Val Glu Glu His  
35 40 45

Thr Lys Pro Ser Tyr Phe Gln Ala Ala Asp Asp Ser Asp Thr Glu Ser  
50 55 60

Glu Pro Glu Ile Glu Asp Asn Gln Gly Leu Tyr Ala Gln Asp Pro Glu  
65 70 75 80

Ala Glu Gln Val Glu Gly Phe Ile Gln Gly Pro Leu Asp Asp Tyr Ala  
85 90 95

Asp Glu Glu Val Asp Val Val Phe Thr Ser Asp Trp Lys Pro Pro Glu  
100 105 110

Leu Glu Ser Asp Glu His Gly Lys Thr Leu Arg Leu Thr Ser Pro Glu  
115 120 125

Gly Leu Ser Gly Glu Gln Lys Ser Gln Trp Leu Ser Thr Ile Lys Ala  
130 135 140

Val Val Gln Ser Ala Lys Tyr Trp Asn Leu Ala Glu Cys Thr Phe Glu  
145 150 155 160

Ala Ser Gly Glu Gly Val Ile Met Lys Glu Arg Gln Ile Thr Pro Asp  
165 170 175

Val Tyr Lys Val Thr Pro Val Met Asn Thr His Pro Ser Gln Ser Glu  
180 185 190

Ala Val Ser Asp Val Trp Ser Leu Ser Lys Thr Ser Met Thr Phe Gln  
195 200 205

Pro Lys Lys Ala Ser Leu Gln Pro Leu Thr Ile Ser Leu Asp Glu Leu  
210 215 220

Phe Ser Ser Arg Gly Glu Phe Ile Ser Val Gly Gly Asp Gly Arg Met  
225 230 235 240

Ser His Lys Glu Ala Ile Leu Leu Gly Leu Arg Tyr Lys Lys Leu Tyr  
245 250 255

Asn Gln Ala Arg Val Lys Tyr Ser Leu  
260 265

<210> 24

<211> 265  
<212> PRT  
<213> Vesicular stomatitis virus

<400> 24

Met Asp Asn Leu Thr Lys Val Arg Glu Tyr Leu Lys Ser Tyr Ser Arg  
1 5 10 15

Leu Asp Gln Ala Val Gly Glu Ile Asp Glu Ile Glu Ala Gln Arg Ala  
20 25 30

Glu Lys Ser Asn Tyr Glu Leu Phe Gln Glu Asp Gly Val Glu Glu His  
35 40 45

Thr Arg Pro Ser Tyr Phe Gln Ala Ala Asp Asp Ser Asp Thr Glu Ser  
50 55 60

Glu Pro Glu Ile Glu Asp Asn Gln Gly Leu Tyr Val Pro Asp Pro Glu  
65 70 75 80

Ala Glu Gln Val Glu Gly Phe Ile Gln Gly Pro Leu Asp Asp Tyr Ala  
85 90 95

Asp Glu Asp Val Asp Val Val Phe Thr Ser Asp Trp Lys Gln Pro Glu  
100 105 110

Leu Glu Ser Asp Glu His Gly Lys Thr Leu Arg Leu Thr Leu Pro Glu  
115 120 125

Gly Leu Ser Gly Glu Gln Lys Ser Gln Trp Leu Leu Thr Ile Lys Ala  
130 135 140

Val Val Gln Ser Ala Lys His Trp Asn Leu Ala Glu Cys Thr Phe Glu  
145 150 155 160

Ala Ser Gly Glu Gly Val Ile Ile Lys Lys Arg Gln Ile Thr Pro Asp  
165 170 175

Val Tyr Lys Val Thr Pro Val Met Asn Thr His Pro Ser Gln Ser Glu  
180 185 190

Ala Val Ser Asp Val Trp Ser Leu Ser Lys Thr Ser Met Thr Phe Gln  
195 200 205

Pro Lys Lys Ala Ser Leu Gln Pro Leu Thr Ile Ser Leu Asp Glu Leu  
210 215 220

Phe Ser Ser Arg Gly Glu Phe Ile Ser Val Gly Gly Asn Gly Arg Met  
225 230 235 240

Ser His Lys Glu Ala Ile Leu Leu Gly Leu Arg Tyr Lys Lys Leu Tyr  
245 250 255

Asn Gln Ala Arg Val Lys Tyr Ser Leu  
260 265

<210> 25  
<211> 190  
<212> PRT  
<213> Vesicular stomatitis virus

<400> 25  
Met Asp Asn Leu Thr Lys Val Arg Glu Tyr Leu Lys Ser Tyr Ser Arg  
1 5 10 15  
Leu Asp Gln Ala Val Gly Glu Ile Asp Glu Ile Glu Ala Gln Arg Ala  
20 25 30  
Glu Lys Ser Asn Tyr Glu Leu Phe Gln Glu Asp Gly Val Glu Glu His  
35 40 45  
Thr Arg Pro Ser Tyr Phe Gln Ala Ala Asp Asp Ser Asp Thr Glu Ser  
50 55 60  
Glu Pro Glu Ile Glu Asp Asn Gln Gly Leu Tyr Val Pro Asp Pro Glu  
65 70 75 80  
Ala Glu Gln Val Glu Gly Phe Ile Gln Gly Pro Leu Asp Asp Tyr Ala  
85 90 95  
Asp Glu Asp Val Asp Val Val Phe Thr Ser Asp Trp Lys Gln Pro Glu  
100 105 110  
Leu Glu Ser Asp Glu His Gly Lys Thr Leu Arg Leu Thr Leu Pro Glu  
115 120 125  
Gly Leu Ser Gly Glu Gln Lys Ser Gln Trp Leu Leu Thr Ile Lys Ala  
130 135 140  
Val Val Gln Ser Ala Lys His Trp Asn Leu Ala Glu Cys Thr Phe Glu  
145 150 155 160  
Ala Ser Gly Glu Gly Val Ile Ile Lys Lys Arg Gln Ile Thr Pro Asp  
165 170 175  
Val Tyr Lys Val Thr Pro Val Met Asn Thr His Pro Ser Gln  
180 185 190

<210> 26  
<211> 265  
<212> PRT  
<213> Vesicular stomatitis virus

<400> 26  
Met Asp Asn Leu Thr Lys Val Arg Glu Tyr Leu Lys Ser Tyr Ser Arg  
1 5 10 15  
Leu Asp Gln Ala Val Gly Glu Ile Asp Glu Ile Glu Ala Gln Arg Ala  
20 25 30  
Glu Lys Ser Asn Tyr Glu Leu Phe Gln Glu Asp Gly Val Glu Glu His  
35 40 45



Thr Arg Pro Ser Tyr Phe Gln Ala Ala Asp Asp Ser Asp Thr Glu Ser  
 50 55 60  
 Glu Pro Glu Ile Glu Asp Asn Gln Gly Leu Tyr Val Pro Asp Pro Glu  
 65 70 75 80  
 Ala Glu Gln Val Glu Gly Phe Ile Gln Gly Pro Leu Asp Asp Tyr Ala  
 85 90 95  
 Asp Glu Asp Val Asp Val Val Phe Thr Ser Asp Trp Lys Gln Pro Glu  
 100 105 110  
 Leu Glu Ser Asp Glu His Gly Lys Thr Leu Arg Leu Thr Leu Pro Glu  
 115 120 125  
 Gly Leu Ser Gly Glu Gln Lys Ser Gln Trp Leu Leu Thr Ile Lys Ala  
 130 135 140  
 Val Val Gln Ser Ala Lys His Trp Asn Leu Ala Glu Cys Thr Phe Glu  
 145 150 155 160  
 Ala Ser Gly Glu Gly Val Ile Ile Lys Lys Arg Gln Ile Thr Pro Asp  
 165 170 175  
 Val Tyr Lys Val Thr Pro Val Met Asn Thr His Pro Ser Gln Ser Glu  
 180 185 190  
 Ala Val Ser Asp Val Trp Ser Leu Ser Lys Thr Ser Met Thr Phe Gln  
 195 200 205  
 Pro Lys Lys Ala Ser Leu Gln Pro Leu Thr Ile Ser Leu Asp Glu Leu  
 210 215 220  
 Phe Ser Ser Arg Gly Glu Phe Ile Ser Val Gly Gly Asn Gly Arg Met  
 225 230 235 240  
 Ser His Lys Glu Ala Ile Leu Leu Gly Leu Arg Tyr Lys Lys Leu Tyr  
 245 250 255  
 Asn Gln Ala Arg Val Lys Tyr Ser Leu  
 260 265

<210> 27  
 <211> 265  
 <212> PRT  
 <213> Vesicular stomatitis virus

<400> 27  
 Met Asp Asn Leu Thr Lys Val Arg Glu Tyr Leu Lys Ser Tyr Ser Arg  
 1 5 10 15  
 Leu Asp Gln Ala Val Gly Glu Ile Asp Glu Ile Glu Ala Gln Arg Ala  
 20 25 30  
 Glu Lys Ser Asn Tyr Glu Leu Phe Gln Glu Asp Gly Val Glu Glu His

35

40

45

Thr Arg Pro Ser Tyr Phe Gln Ala Ala Asp Asp Ser Asp Thr Glu Ser  
50 55 60

Glu Pro Glu Ile Glu Asp Asn Gln Gly Leu Tyr Val Pro Asp Pro Glu  
65 70 75 80

Ala Glu Gln Val Glu Gly Phe Ile Gln Gly Pro Leu Asp Asp Tyr Ala  
85 90 95

Asp Glu Asp Val Asp Val Val Phe Thr Ser Asp Trp Lys Gln Pro Glu  
100 105 110

Leu Glu Ser Asp Glu His Gly Lys Thr Leu Arg Leu Thr Leu Pro Glu  
115 120 125

Gly Leu Ser Gly Glu Gln Lys Ser Gln Trp Leu Leu Thr Ile Lys Ala  
130 135 140

Val Val Gln Ser Ala Lys His Trp Asn Leu Ala Glu Cys Thr Phe Glu  
145 150 155 160

Ala Ser Gly Glu Gly Val Ile Ile Lys Lys Arg Gln Ile Thr Pro Asp  
165 170 175

Val Tyr Lys Val Thr Pro Val Met Asn Thr His Pro Ser Gln Ser Glu  
180 185 190

Ala Val Ser Asp Val Trp Ser Leu Ser Lys Thr Ser Met Thr Phe Gln  
195 200 205

Pro Lys Lys Ala Ser Leu Gln Pro Leu Thr Ile Ser Leu Asp Glu Leu  
210 215 220

Phe Ser Ser Arg Gly Glu Phe Ile Ser Val Gly Gly Asn Gly Arg Met  
225 230 235 240

Ser His Lys Glu Ala Ile Leu Leu Gly Leu Arg Tyr Lys Lys Leu Tyr  
245 250 255

Asn Gln Ala Arg Val Lys Tyr Ser Leu  
260 265

<210> 28

<211> 690

<212> DNA

<213> Vesicular stomatitis virus

<400> 28

atgagttcct taaagaagat tctcgggtctg aaggggaaag gtaagaaatc taagaaatta 60  
gggatcgac cacccttta tgaagaggac actagcatgg agtatgctcc gagcgctcca 120  
attgacaaat cctatttttg agttgacgag atggacacct atgatccgaa tcaattaaga 180  
tatgagaaat tcttctttac agtgaaaatg acggtttagat ctaatcgctc gttcagaaca 240  
tactcagatg tggcagccgc tgtatcccat tgggacacac tgtacatcgg aatggcaggg 300  
aaacgtccct tctacaaaat cttgggtttt ttgggttctt ctaatctaaa ggccactcca 360

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gcggtatttg cagatcaagg tcaaccagag tatcacactc actgcgaagg cagggcttat 420
ttgccacata ggatggggaa gacccctccc atgctcaatg taccagagca cttcagaaga 480
ccattcaata taggtcttta caagggaacg attgagctca caatgaccat ctacgatgat 540
gagtcactgg aagcagctcc tatgatctgg gatcatttca attcttccaa attttctgat 600
ttcagagaga aggccttaat gtttggcctg attgtcgaga aaaaggcatc tggagcgtgg 660
gtcctggatt ctatcagcca cttcaaatga 690

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<210> 29

<211> 690

<212> DNA

<213> Vesicular stomatitis virus

<400> 29

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atgagttcct taaagaagat tctcggctctg aaggggaaag gtaagaaatc taagaaatta 60
gggatcgcac caccctctta tgaagaggac actaacatgg agtatgctcc gagcgctcca 120
attgacaaat cctatttttg agttgacgag atggacactc atgatccgca tcaattaaga 180
tatgagaaat tcttctttac agtgaaaatg acggttagat ctaatcgtcc gttcagaaca 240
tactcagatg tggcagccgc tgtatcccat tgggatcaca tgtacatcgg aatggcaggg 300
aaacgtccct tctacaagat cttggctttt ttgggttctt ctaatctaaa ggccactcca 360
gcggtatttg cagatcaagg tcaaccagag tatcacgctc actgtgaagg cagggcttat 420
ttgccacaca gaatggggaa gacccctccc atgctcaatg taccagagca cttcagaaga 480
ccattcaata taggtcttta caagggaacg gttgagctca caatgaccat ctacgatgat 540
gagtcactgg aagcagctcc tatgatctgg gatcatttca attcttccaa attttctgat 600
ttcagagaga aggccttaat gtttggcctg attgtcgaga aaaaggcatc tggagcgtgg 660
gtcctggatt ctgtcagcca cttcaaatga 690

```

<210> 30

<211> 690

<212> DNA

<213> Vesicular stomatitis virus

<400> 30

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atgagttcct taaagaagat tctcggctctg aaggggaaag gtaagaaatc taagaaatta 60
gggatcgcac caccctctta tgaagaggac actaacatgg agtatgctcc gagcgctcca 120
attgacaaat cctatttttg agttgacgag agggacactc atgatccgca tcaattaaga 180
tatgagaaat tcttctttac agtgaaaatg acggttagat ctaatcgtcc gttcagaaca 240
tactcagatg tggcagccgc tgtatcccat tgggatcaca tgtacatcgg aatggcaggg 300
aaacgtccct tctacaagat cttggctttt ttgggttctt ctaatctaaa ggccactcca 360
gcggtatttg cagatcaagg tcaaccagag tatcacgctc actgtgaagg cagggcttat 420
ttgccacaca gaatggggaa gacccctccc atgctcaatg taccagagca cttcagaaga 480
ccattcaata taggtcttta caagggaacg gttgagctca caatgaccat ctacgatgat 540
gagtcactgg aagcagctcc tatgatctgg gatcatttca attcttccaa attttctgat 600
ttcagagaga aggccttaat gtttggcctg attgtcgaga aaaaggcatc tggagcgtgg 660
gtcctggatt ctgtcagcca cttcaaatga 690

```

<210> 31

<211> 690

<212> DNA

<213> Vesicular stomatitis virus

<400> 31

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atgagttcct taaagaagat tctcggctctg aaggggaaag gtaagaaatc taagaaatta 60
gggatcgcac caccctctta tgaagaggac actaacatgg agtatgctcc gagcgctcca 120
attgacaaat cctatttttg agttgacgag atggacactc atgatccgca tcaattaaga 180

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tatgagaaat tcttctttac agtgaaaatg acgggttagat ctaatcggtcc gttcagaaca 240  
tactcagatg tggcagccgc tgtatcccat tgggatcaca tgtacatcgg aatggcaggg 300  
aaacgtccct tctacaagat cttggctttt ttgggttctt ctaatctaaa ggccactcca 360  
gcggtattgg cagatcaagg tcaaccagag tatcacgctc actgtgaagg cagggcttat 420  
ttgccacaca gaatggggaa gacccctccc atgctcaatg taccagagca cttcagaaga 480  
ccattcaata taggtcttta caagggaacg gttgagctca caatgacat ctacgatgat 540  
gagtcactgg aagcagctcc tatgatctgg gatcatttca attcttccaa attttctgat 600  
ttcagagaga aggccttaat gtttggcctg attgtcgaga aaaaggcatc tggagcttgg 660  
gtcctggatt ctgtcagcca cttcaaatga 690

<210> 32

<211> 229

<212> PRT

<213> Vesicular stomatitis virus

<400> 32

Met Ser Ser Leu Lys Lys Ile Leu Gly Leu Lys Gly Lys Gly Lys Lys  
1 5 10 15

Ser Lys Lys Leu Gly Ile Ala Pro Pro Pro Tyr Glu Glu Asp Thr Ser  
20 25 30

Met Glu Tyr Ala Pro Ser Ala Pro Ile Asp Lys Ser Tyr Phe Gly Val  
35 40 45

Asp Glu Met Asp Thr Tyr Asp Pro Asn Gln Leu Arg Tyr Glu Lys Phe  
50 55 60

Phe Phe Thr Val Lys Met Thr Val Arg Ser Asn Arg Pro Phe Arg Thr  
65 70 75 80

Tyr Ser Asp Val Ala Ala Ala Val Ser His Trp Asp His Met Tyr Ile  
85 90 95

Gly Met Ala Gly Lys Arg Pro Phe Tyr Lys Ile Leu Ala Phe Leu Gly  
100 105 110

Ser Ser Asn Leu Lys Ala Thr Pro Ala Val Leu Ala Asp Gln Gly Gln  
115 120 125

Pro Glu Tyr His Thr His Cys Glu Gly Arg Ala Tyr Leu Pro His Arg  
130 135 140

Met Gly Lys Thr Pro Pro Met Leu Asn Val Pro Glu His Phe Arg Arg  
145 150 155 160

Pro Phe Asn Ile Gly Leu Tyr Lys Gly Thr Ile Glu Leu Thr Met Thr  
165 170 175

Ile Tyr Asp Asp Glu Ser Leu Glu Ala Ala Pro Met Ile Trp Asp His  
180 185 190

Phe Asn Ser Ser Lys Phe Ser Asp Phe Arg Glu Lys Ala Leu Met Phe  
195 200 205

Gly Leu Ile Val Glu Lys Lys Ala Ser Gly Ala Trp Val Leu Asp Ser

210

215

220

Ile Ser His Phe Lys  
225

&lt;210&gt; 33

&lt;211&gt; 229

&lt;212&gt; PRT

&lt;213&gt; Vesicular stomatitis virus

&lt;400&gt; 33

Met Ser Ser Leu Lys Lys Ile Leu Gly Leu Lys Gly Lys Gly Lys Lys  
1 5 10 15

Ser Lys Lys Leu Gly Ile Ala Pro Pro Tyr Glu Glu Asp Thr Asn  
20 25 30

Met Glu Tyr Ala Pro Ser Ala Pro Ile Asp Lys Ser Tyr Phe Gly Val  
35 40 45

Asp Glu Met Asp Thr His Asp Pro His Gln Leu Arg Tyr Glu Lys Phe  
50 55 60

Phe Phe Thr Val Lys Met Thr Val Arg Ser Asn Arg Pro Phe Arg Thr  
65 70 75 80

Tyr Ser Asp Val Ala Ala Ala Val Ser His Trp Asp His Met Tyr Ile  
85 90 95

Gly Met Ala Gly Lys Arg Pro Phe Tyr Lys Ile Leu Ala Phe Leu Gly  
100 105 110

Ser Ser Asn Leu Lys Ala Thr Pro Ala Val Leu Ala Asp Gln Gly Gln  
115 120 125

Pro Glu Tyr His Ala His Cys Glu Gly Arg Ala Tyr Leu Pro His Arg  
130 135 140

Met Gly Lys Thr Pro Pro Met Leu Asn Val Pro Glu His Phe Arg Arg  
145 150 155 160

Pro Phe Asn Ile Gly Leu Tyr Lys Gly Thr Val Glu Leu Thr Met Thr  
165 170 175

Ile Tyr Asp Asp Glu Ser Leu Glu Ala Ala Pro Met Ile Trp Asp His  
180 185 190

Phe Asn Ser Ser Lys Phe Ser Asp Phe Arg Glu Lys Ala Leu Met Phe  
195 200 205

Gly Leu Ile Val Glu Lys Lys Ala Ser Gly Ala Trp Val Leu Asp Ser  
210 215 220

Val Ser His Phe Lys  
225

<210> 34  
<211> 229  
<212> PRT  
<213> Vesicular stomatitis virus

<400> 34  
Met Ser Ser Leu Lys Lys Ile Leu Gly Leu Lys Gly Lys Gly Lys Lys  
1 5 10 15  
Ser Lys Lys Leu Gly Ile Ala Pro Pro Pro Tyr Glu Glu Asp Thr Asn  
20 25 30  
Met Glu Tyr Ala Pro Ser Ala Pro Ile Asp Lys Ser Tyr Phe Gly Val  
35 40 45  
Asp Glu Met Asp Thr His Asp Pro His Gln Leu Arg Tyr Glu Lys Phe  
50 55 60  
Phe Phe Thr Val Lys Met Thr Val Arg Ser Asn Arg Pro Phe Arg Thr  
65 70 75 80  
Tyr Ser Asp Val Ala Ala Ala Val Ser His Trp Asp His Met Tyr Ile  
85 90 95  
Gly Met Ala Gly Lys Arg Pro Phe Tyr Lys Ile Leu Ala Phe Leu Gly  
100 105 110  
Ser Ser Asn Leu Lys Ala Thr Pro Ala Val Leu Ala Asp Gln Gly Gln  
115 120 125  
Pro Glu Tyr His Ala His Cys Glu Gly Arg Ala Tyr Leu Pro His Arg  
130 135 140  
Met Gly Lys Thr Pro Pro Met Leu Asn Val Pro Glu His Phe Arg Arg  
145 150 155 160  
Pro Phe Asn Ile Gly Leu Tyr Lys Gly Thr Val Glu Leu Thr Met Thr  
165 170 175  
Ile Tyr Asp Asp Glu Ser Leu Glu Ala Ala Pro Met Ile Trp Asp His  
180 185 190  
Phe Asn Ser Ser Lys Phe Ser Asp Phe Arg Glu Lys Ala Leu Met Phe  
195 200 205  
Gly Leu Ile Val Glu Lys Lys Ala Ser Gly Ala Trp Val Leu Asp Ser  
210 215 220  
Val Ser His Phe Lys  
225

<210> 35  
<211> 229  
<212> PRT  
<213> Vesicular stomatitis virus

<400> 35

Met Ser Ser Leu Lys Lys Ile Leu Gly Leu Lys Gly Lys Gly Lys Lys  
1 5 10 15

Ser Lys Lys Leu Gly Ile Ala Pro Pro Pro Tyr Glu Glu Asp Thr Asn  
20 25 30

Met Glu Tyr Ala Pro Ser Ala Pro Ile Asp Lys Ser Tyr Phe Gly Val  
35 40 45

Asp Glu Arg Asp Thr His Asp Pro His Gln Leu Arg Tyr Glu Lys Phe  
50 55 60

Phe Phe Thr Val Lys Met Thr Val Arg Ser Asn Arg Pro Phe Arg Thr  
65 70 75 80

Tyr Ser Asp Val Ala Ala Ala Val Ser His Trp Asp His Met Tyr Ile  
85 90 95

Gly Met Ala Gly Lys Arg Pro Phe Tyr Lys Ile Leu Ala Phe Leu Gly  
100 105 110

Ser Ser Asn Leu Lys Ala Thr Pro Ala Val Leu Ala Asp Gln Gly Gln  
115 120 125

Pro Glu Tyr His Ala His Cys Glu Gly Arg Ala Tyr Leu Pro His Arg  
130 135 140

Met Gly Lys Thr Pro Pro Met Leu Asn Val Pro Glu His Phe Arg Arg  
145 150 155 160

Pro Phe Asn Ile Gly Leu Tyr Lys Gly Thr Val Glu Leu Thr Met Thr  
165 170 175

Ile Tyr Asp Asp Glu Ser Leu Glu Ala Ala Pro Met Ile Trp Asp His  
180 185 190

Phe Asn Ser Ser Lys Phe Ser Asp Phe Arg Glu Lys Ala Leu Met Phe  
195 200 205

Gly Leu Ile Val Glu Lys Lys Ala Ser Gly Ala Trp Val Leu Asp Ser  
210 215 220

Val Ser His Phe Lys  
225

<210> 36

<211> 1536

<212> DNA

<213> Vesicular stomatitis virus

<400> 36

atgaagtgcc ttttgtactt agccttttta ttcattgggg tgaattgcaa gttcaccata 60  
gtttttccac acaacccaaa aggaactgg aaaaatgttc cttctaatta ccattattgc 120  
ccgtcaagct cagatttaaa ttggcataat gacttaatag gcacagccat acaagtcaaa 180

```

atgccccaga gtcacaaggc tattcaagca gacggttgga tgtgtcatgc ttccaaatgg 240
gtcactactt gtgatttccg ctggtatgga ccgaagtata taacacagtc catccgatcc 300
ttcactccat ctgtagaaca atgcaaggaa agcattgaac aaacgaaaca aggaacttgg 360
ctgaatccag gcttccctcc tcaaagttgt ggatatgcaa ctgtgacgga tgccgaagca 420
gtgattgtcc aggtgactcc tcaccatgtg ctggttgatg aatacacagg agaatgggtt 480
gattcacagt tcatcaacgg aaaatgcagc aattacatat gccccactgt ccataactct 540
acaacctggc attctgacta taaggtcaaa gggctatgtg attctaacct catttccatg 600
gacatcacct tcttctcaga ggacggagag ctatcatccc tgggaaagga gggcacaggg 660
ttcagaagta actactttgc ttatgaaact ggaggcaagg cctgcaaaat gcaatactgc 720
aagcattggg gagtcagact cccatcagggt gtctgggttc agatgggtga taaggatctc 780
tttgctgcag ccagattccc tgaatgcccc gaagggtcaa gtatctctgc tccatctcag 840
acctcagtgg atgtaagtct aattcaggac gttgagagga tcttggatta ttccctctgc 900
caagaaacct ggagcaaaat cagagcgggt cttccaatct ctccagtggg tctcagctat 960
cttgctccta aaaacccagg aaccgggtct gctttcacca taatcaatgg taccctaaaa 1020
tactttgaga ccagatacat cagagtcgat attgctgctc caatcctctc aagaatgggtc 1080
ggaatgatca gtggaactac cacagaaagg gaactgtggg atgactgggc accatatgaa 1140
gacgtggaaa ttggacccaa tggagttctg aggaccagtt caggatataa gtttccttta 1200
tacatgattg gacatgggat gttggactcc gatcttcac ttagtcaaaa ggctcagggtg 1260
ttcgaacatc ctcacattca agacgctgct tcgcaacttc ctgatgatga gagtttattt 1320
tttggtgata ctgggctatc caaaaatcca atcgagcttg tagaagggtt gttcagtagt 1380
tggaaaagct ctattgcctc ttttttcttt atcataggggt taatcattgg actattcttg 1440
gttctccgag ttggtatcca tctttgcatt aaattaaagc acaccaagaa aagacagatt 1500
tatacagaca tagagatgaa ccgacttgga aagtaa 1536

```

<210> 37

<211> 885

<212> DNA

<213> Vesicular stomatitis virus

<220>

<221> modified\_base

<222> (1)..(885)

<223> "n" represents a, t, c, g, other or unknown

<400> 37

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atgaagtgcc ttttgkactt agctttttta ttcacogggg tgaattgcaa gttcaccata 60
gtttttccat acaacccaaa aggaaactgg aaaaatgttc cttccaatta ccattattgc 120
ccgtcaagct cagattttaa ttgncataat gacttaatag gcacagcctt acaagtcaaa 180
atgccccaga gtcacaaggc tattcaagca gacggttgga tgtgtcatgc ttccaaatgg 240
gtcactactt gtgatttccg ctggtacgga ccgaagtata taacacattc catccgatcc 300
ttcactccat ctgtagaaca atgcaaggaa agcattgaac aaacgaaaca aggaacttgg 360
ctgaatccag gcttccctcc tcaaagttgt ggatatgcaa ctgtgacgga tgctgaagca 420
gcgattgtcc aggtgactcc tcaccatgtg cttgttgatg aatacacagg agaatgggtt 480
gattcacagt tcatcaacgg aaaatgcagc aatgacatat gccccactgt ccataactcc 540
acaacctggc attccgacta taaggtcaaa gggctatgtg attctaacct catttccatg 600
gacatcacct tcttctcaga ggacggagag ctatcatccc taggaaagga gggcacaggg 660
ttcagaagta actactttgc ttatgaaact ggagacaagg cctgcaaaat gcagtactgc 720
aagcgttggg gagtcagact cccatcagggt gtctgggttc agatgggtga taaggatctc 780
tttgctgcag ccagattccc tgaatgcccc gaagggtcaa gtatctctgc tccatctcag 840
acctcagtgg atgtaagtct cattcaggac gttgagagga tcttg 885

```

<210> 38

<211> 705

<212> DNA

<213> Vesicular stomatitis virus



<400> 38

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ccatctcaga cctcagtgga tgtaagtctc attcaggacg ttgagaggat cttggattat 60
tccctctgcc aagaaacctg gagcaaaatc agagcgggtc ttcccatctc tccagtggat 120
ctcagctatc ttgctcctaa aaaccaggga accggtcctg tctttacat aatcaatggg 180
accctaaaat actttgagac cagatacatc agagtcgata ttgctgctcc aatcctctca 240
agaatgggtc gaatgatcag tggaaactacc acagaaaggg aactgtggga tgactgggct 300
ccatatgaag acgtggaaat tggacccaat ggagttctga ggaccagttc aggatataag 360
tttcctttat atatgattgg acatgggtatg ttggactccg atcttcatct tagctcaaag 420
gctcaggtgt ttgaacatcc tcacattcaa gacgctgctt cgcagcttcc tgatgatgag 480
actttatttt ttggtgatac tgggctatcc aaaaatccaa tcgagtttgt agaaggttgg 540
ttcagtagtt ggaagagctc tattgcctct tttttcttta tcatagggtt aatcattgga 600
ctattcttgg ttctccgagt tgggtatttt ctttgcatta aattaaagca caccaagaaa 660
agacagattt atacagacat agagatgaac cgacttggga agtaa 705
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<210> 39

<211> 1536

<212> DNA

<213> Vesicular stomatitis virus

<400> 39

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atgaagtgcc ttttgtactt agctttttta ttcacgggg tgaattgcaa gttcaccata 60
gtttttccat acaaccgaaa aggaaactgg aaaaatgttc cttccaatta ccattattgc 120
ccgtcaagct cagattttaa ttggcataat gacttaatag gcacagcctt acaagtcaaa 180
atgcccaaga gtcacaaggc tattcaagca gacggttgga tgtgtcatgc ttccaaatgg 240
gtcactactt gtgatttccg ctggtacgga ccgaagtata taacacattc catccgatcc 300
ttcactccat ctgtagaaca atgcaaggaa agcattgaac aaacgaaaca aggaacttgg 360
ctgaatccag gcttccctcc tcaaagttgt ggatatgcaa ctgtgacgga tgctgaagca 420
gcgattgtcc aggtgactcc tcaccatgtg cttgttgatg aatacacagg agaatgggtt 480
gattcacagt tcatcaacgg aaaatgcagc aatgacatat gccccactgt ccataactcc 540
acaacctggc attccgacta taagggtcaa gggctatgtg attctaacct catttccatg 600
gacatcacct tcttctcaga ggacggagag ctatcatccc taggaaagga gggcacaggg 660
ttcagaagta actactttgc ttatgaaact ggagacaagg cctgcaaaat gcagtactgc 720
aagcattggg gagtcagact cccatcaggt gtctggttcg agatggctga taaggatctc 780
tttgctgcag ccagattccc tgaatgccc gaagggtcaa gtatctctgc tccatctcag 840
acctcagtgg atgtaagtct cattcaggac gttgagagga tcttggatta ttccctctgc 900
caagaaacct ggagcaaaat cagagcgggt cttcccatct ctccagtgga tctcagctat 960
cttgctccta aaaaccagg aaccggtcct gctttcacca taatcaatgg taccctaaaa 1020
tactttgaga ccagatacat cagagtcgat attgtgctc caatcctctc aagaatgggtc 1080
ggaatgatca gtggaactac cacagaaagg gaactgtggg atgactgggc tccatatgaa 1140
gacgtggaaa ttggaccaa tggagttctg aggaccagtt caggatataa gtttcttcta 1200
tatatgattg gacatggtat gttggactcc gatcttcac ttagctcaaa ggctcaggtg 1260
tttgaacatc ctcacattca agacgctght gcgcagcttc ctgatgatga gactttattt 1320
tttggtgata ctgggctatc caaaaatcca atcgagtttg tagaaggttg gttcagtagt 1380
tggaagagct ctattgcctc ttttttcttt atcatagggt taatcattgg actattcttg 1440
gttctccgag ttggtattta tctttgcatt aaattaaagc acaccaagaa aagacagatt 1500
tatacagaca tagagatgaa ccgacttggg aagtaa 1536
```

<210> 40

<211> 1399

<212> DNA

<213> Vesicular stomatitis virus

<400> 40

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atgaagtgcc ttttgtactt agctttttta ttcacgggg tgaattgcaa gttcaccata 60
```

gtttttccat acaacccaaa aggaaactgg aaaaatgttc cttccaatta ccattattgc 120  
 ccgtcaagct cagattttaa ttggcataat gacttaatat gcacagcctt acaggtcaaa 180  
 atgcccaga gtcacaaggc tattcaagca gacgggttga tgtgtcatgc ttccaaatgg 240  
 gtcactactt gtgatttccg ctggtacgga ccgaagtata taacacattc catccgatcc 300  
 ttcaactccat ctgtagaaca atgcaaggaa agcattgaac aaacgaaaca aggaacttgg 360  
 ctgaatccag gcttccctcc tcaaagtgtt ggatatgcaa ctgtgacgga tgctgaagca 420  
 gcgattgtcc aggtgactcc tcaccatgtg cttgttgatg aatacacagg agaatgggtt 480  
 gattcacagt tcatcaacgg aaaatgcagc aatgacatat gcccactgt ccataactcc 540  
 acaacctggc attccgacta taaggtcaaa gggctatgtg attctaactc catttccatg 600  
 gacatcacct tcttctcaga ggacggagag ctatcatccc taggaaagga gggcacaggg 660  
 ttcagaagta actactttgc ttatgaaact ggagacaagg cctgcaaaat gcagtactgc 720  
 aagcgttggg gagtcagact cccatcaggt gtctgggttc ggatggctga taaggatctc 780  
 tttgtgcag ccagattccc tgaatgcccc gaagggtcaa gtatctctgc tccatctcag 840  
 acctcagtgg atgtaagtct cattcaggac gttgagagga tcttactttg agaccagata 900  
 catcagagtc gatattgctg ctccaatcct ctcaagaatg gtcggaatga tcagtgggaa 960  
 taccacagaa agggaaactgt gggatgactg ggtcccatat gaagacgtgg aaattggacc 1020  
 caatggagtt ctgaggacca gtccaggata taagtttcc tttatatga ttggacatgg 1080  
 tatgttggac tccgatcttc atcttagctc aaaggctcag gtgtttgaac atctcacat 1140  
 tcaagacgct gcttcgcagc ttctgatga tgagacttta ttttttgggtg atactgggct 1200  
 atccaaaaat ccaatcgagt ttgtagaagg ttggttcagt agttggaaga gctctattgc 1260  
 ctcttttttc tttatcatag ggttaatcat tggactattc ttggttctcc gagttggat 1320  
 ttatctttgc attaaattaa agcacaccaa gaaaagacag atttatacag acatagagat 1380  
 gaaccgactt gggaagtaa 1399

<210> 41  
 <211> 511  
 <212> PRT  
 <213> Vesicular stomatitis virus

<400> 41  
 Met Lys Cys Leu Leu Tyr Leu Ala Phe Leu Phe Ile Gly Val Asn Cys 15  
 1 5 10  
 Lys Phe Thr Ile Val Phe Pro His Asn Gln Lys Gly Asn Trp Lys Asn 30  
 20 25 30  
 Val Pro Ser Asn Tyr His Tyr Cys Pro Ser Ser Ser Asp Leu Asn Trp 45  
 35 40 45  
 His Asn Asp Leu Ile Gly Thr Ala Ile Gln Val Lys Met Pro Lys Ser 60  
 50 55 60  
 His Lys Ala Ile Gln Ala Asp Gly Trp Met Cys His Ala Ser Lys Trp 80  
 65 70 75 80  
 Val Thr Thr Cys Asp Phe Arg Trp Tyr Gly Pro Lys Tyr Ile Thr Gln 95  
 85 90 95  
 Ser Ile Arg Ser Phe Thr Pro Ser Val Glu Gln Cys Lys Glu Ser Ile 110  
 100 105 110  
 Glu Gln Thr Lys Gln Gly Thr Trp Leu Asn Pro Gly Phe Pro Pro Gln 125  
 115 120 125  
 Ser Cys Gly Tyr Ala Thr Val Thr Asp Ala Glu Ala Val Ile Val Gln 140  
 130 135 140

Val Thr Pro His His Val Leu Val Asp Glu Tyr Thr Gly Glu Trp Val 160  
 145 150 155

Asp Ser Gln Phe Ile Asn Gly Lys Cys Ser Asn Tyr Ile Cys Pro Thr 175  
 165 170

Val His Asn Ser Thr Thr Trp His Ser Asp Tyr Lys Val Lys Gly Leu 190  
 180 185

Cys Asp Ser Asn Leu Ile Ser Met Asp Ile Thr Phe Phe Ser Glu Asp 205  
 195 200

Gly Glu Leu Ser Ser Leu Gly Lys Glu Gly Thr Gly Phe Arg Ser Asn 220  
 210 215

Tyr Phe Ala Tyr Glu Thr Gly Gly Lys Ala Cys Lys Met Gln Tyr Cys 240  
 225 230 235

Lys His Trp Gly Val Arg Leu Pro Ser Gly Val Trp Phe Glu Met Ala 255  
 245 250

Asp Lys Asp Leu Phe Ala Ala Ala Arg Phe Pro Glu Cys Pro Glu Gly 270  
 260 265

Ser Ser Ile Ser Ala Pro Ser Gln Thr Ser Val Asp Val Ser Leu Ile 285  
 275 280

Gln Asp Val Glu Arg Ile Leu Asp Tyr Ser Leu Cys Gln Glu Thr Trp 300  
 290 295

Ser Lys Ile Arg Ala Gly Leu Pro Ile Ser Pro Val Asp Leu Ser Tyr 320  
 305 310 315

Leu Ala Pro Lys Asn Pro Gly Thr Gly Pro Ala Phe Thr Ile Ile Asn 335  
 325 330

Gly Thr Leu Lys Tyr Phe Glu Thr Arg Tyr Ile Arg Val Asp Ile Ala 350  
 340 345

Ala Pro Ile Leu Ser Arg Met Val Gly Met Ile Ser Gly Thr Thr Thr 365  
 355 360

Glu Arg Glu Leu Trp Asp Asp Trp Ala Pro Tyr Glu Asp Val Glu Ile 380  
 370 375

Gly Pro Asn Gly Val Leu Arg Thr Ser Ser Gly Tyr Lys Phe Pro Leu 400  
 385 390 395

Tyr Met Ile Gly His Gly Met Leu Asp Ser Asp Leu His Leu Ser Ser 415  
 405 410

Lys Ala Gln Val Phe Glu His Pro His Ile Gln Asp Ala Ala Ser Gln 430  
 420 425

Leu Pro Asp Asp Glu Ser Leu Phe Phe Gly Asp Thr Gly Leu Ser Lys 445  
 435 440

Asn Pro Ile Glu Leu Val Glu Gly Trp Phe Ser Ser Trp Lys Ser Ser  
450 455 460

Ile Ala Ser Phe Phe Phe Ile Ile Gly Leu Ile Ile Gly Leu Phe Leu  
465 470 475 480

Val Leu Arg Val Gly Ile His Leu Cys Ile Lys Leu Lys His Thr Lys  
485 490 495

Lys Arg Gln Ile Tyr Thr Asp Ile Glu Met Asn Arg Leu Gly Lys  
500 505 510

<210> 42

<211> 295

<212> PRT

<213> Vesicular stomatitis virus

<220>

<221> MOD\_RES

<222> (1)..(295)

<223> "Xaa" represents any, other or unknown amino acid

<400> 42

Met Lys Cys Leu Leu Xaa Leu Ala Phe Leu Phe Ile Gly Val Asn Cys  
1 5 10 15

Lys Phe Thr Ile Val Phe Pro Tyr Asn Gln Lys Gly Asn Trp Lys Asn  
20 25 30

Val Pro Ser Asn Tyr His Tyr Cys Pro Ser Ser Ser Asp Leu Asn Xaa  
35 40 45

His Asn Asp Leu Ile Gly Thr Ala Leu Gln Val Lys Met Pro Lys Ser  
50 55 60

His Lys Ala Ile Gln Ala Asp Gly Trp Met Cys His Ala Ser Lys Trp  
65 70 75 80

Val Thr Thr Cys Asp Phe Arg Trp Tyr Gly Pro Lys Tyr Ile Thr His  
85 90 95

Ser Ile Arg Ser Phe Thr Pro Ser Val Glu Gln Cys Lys Glu Ser Ile  
100 105 110

Glu Gln Thr Lys Gln Gly Thr Trp Leu Asn Pro Gly Phe Pro Pro Gln  
115 120 125

Ser Cys Gly Tyr Ala Thr Val Thr Asp Ala Glu Ala Ala Ile Val Gln  
130 135 140

Val Thr Pro His His Val Leu Val Asp Glu Tyr Thr Gly Glu Trp Val  
145 150 155 160

Asp Ser Gln Phe Ile Asn Gly Lys Cys Ser Asn Asp Ile Cys Pro Thr  
165 170 175

Val His Asn Ser Thr Thr Trp His Ser Asp Tyr Lys Val Lys Gly Leu  
180 185 190

Cys Asp Ser Asn Leu Ile Ser Met Asp Ile Thr Phe Phe Ser Glu Asp  
195 200 205

Gly Glu Leu Ser Ser Leu Gly Lys Glu Gly Thr Gly Phe Arg Ser Asn  
210 215 220

Tyr Phe Ala Tyr Glu Thr Gly Asp Lys Ala Cys Lys Met Gln Tyr Cys  
225 230 235 240

Lys Arg Trp Gly Val Arg Leu Pro Ser Gly Val Trp Phe Glu Met Ala  
245 250 255

Asp Lys Asp Leu Phe Ala Ala Ala Arg Phe Pro Glu Cys Pro Glu Gly  
260 265 270

Ser Ser Ile Ser Ala Pro Ser Gln Thr Ser Val Asp Val Ser Leu Ile  
275 280 285

Gln Asp Val Glu Arg Ile Leu  
290 295

<210> 43

<211> 234

<212> PRT

<213> Vesicular stomatitis virus

<400> 43

Pro Ser Gln Thr Ser Val Asp Val Ser Leu Ile Gln Asp Val Glu Arg  
1 5 10 15

Ile Leu Asp Tyr Ser Leu Cys Gln Glu Thr Trp Ser Lys Ile Arg Ala  
20 25 30

Gly Leu Pro Ile Ser Pro Val Asp Leu Ser Tyr Leu Ala Pro Lys Asn  
35 40 45

Pro Gly Thr Gly Pro Val Phe Thr Ile Ile Asn Gly Thr Leu Lys Tyr  
50 55 60

Phe Glu Thr Arg Tyr Ile Arg Val Asp Ile Ala Ala Pro Ile Leu Ser  
65 70 75 80

Arg Met Val Gly Met Ile Ser Gly Thr Thr Thr Glu Arg Glu Leu Trp  
85 90 95

Asp Asp Trp Ala Pro Tyr Glu Asp Val Glu Ile Gly Pro Asn Gly Val  
100 105 110

Leu Arg Thr Ser Ser Gly Tyr Lys Phe Pro Leu Tyr Met Ile Gly His  
115 120 125

Gly Met Leu Asp Ser Asp Leu His Leu Ser Ser Lys Ala Gln Val Phe

130                      135                      140  
 Glu His Pro His Ile Gln Asp Ala Ala Ser Gln Leu Pro Asp Asp Glu  
 145                      150                      155                      160  
 Thr Leu Phe Phe Gly Asp Thr Gly Leu Ser Lys Asn Pro Ile Glu Phe  
                     165                      170                      175  
 Val Glu Gly Trp Phe Ser Ser Trp Lys Ser Ser Ile Ala Ser Phe Phe  
                     180                      185                      190  
 Phe Ile Ile Gly Leu Ile Ile Gly Leu Phe Leu Val Leu Arg Val Gly  
                     195                      200                      205  
 Ile Tyr Leu Cys Ile Lys Leu Lys His Thr Lys Lys Arg Gln Ile Tyr  
                     210                      215                      220  
 Thr Asp Ile Glu Met Asn Arg Leu Gly Lys  
 225                      230

<210> 44  
 <211> 511  
 <212> PRT  
 <213> Vesicular stomatitis virus  
  
 <220>  
 <221> MOD\_RES  
 <222> (1)..(511)  
 <223> "Xaa" represents any, other or unknown amino acid

<400> 44  
 Met Lys Cys Leu Leu Tyr Leu Ala Phe Leu Phe Ile Gly Val Asn Cys  
   1                    5                    10                    15  
 Lys Phe Thr Ile Val Phe Pro Tyr Asn Arg Lys Gly Asn Trp Lys Asn  
                     20                    25                    30  
 Val Pro Ser Asn Tyr His Tyr Cys Pro Ser Ser Ser Asp Leu Asn Trp  
                     35                    40                    45  
 His Asn Asp Leu Ile Gly Thr Ala Leu Gln Val Lys Met Pro Lys Ser  
                     50                    55                    60  
 His Lys Ala Ile Gln Ala Asp Gly Trp Met Cys His Ala Ser Lys Trp  
   65                    70                    75                    80  
 Val Thr Thr Cys Asp Phe Arg Trp Tyr Gly Pro Lys Tyr Ile Thr His  
                     85                    90                    95  
 Ser Ile Arg Ser Phe Thr Pro Ser Val Glu Gln Cys Lys Glu Ser Ile  
                     100                    105                    110  
 Glu Gln Thr Lys Gln Gly Thr Trp Leu Asn Pro Gly Phe Pro Pro Gln  
                     115                    120                    125  
 Ser Cys Gly Tyr Ala Thr Val Thr Asp Ala Glu Ala Ala Ile Val Gln

130		135		140
Val Thr Pro His His	Val Leu Val Asp Glu Tyr Thr Gly Glu Trp Val			
145	150	155		160
Asp Ser Gln Phe Ile	Asn Gly Lys Cys Ser Asn Asp Ile Cys Pro Thr			
165	170	175		
Val His Asn Ser Thr Thr Trp His Ser Asp Tyr Lys Val Lys Gly Leu				
180	185	190		
Cys Asp Ser Asn Leu Ile Ser Met Asp Ile Thr Phe Phe Ser Glu Asp				
195	200	205		
Gly Glu Leu Ser Ser Leu Gly Lys Glu Gly Thr Gly Phe Arg Ser Asn				
210	215	220		
Tyr Phe Ala Tyr Glu Thr Gly Asp Lys Ala Cys Lys Met Gln Tyr Cys				
225	230	235		240
Lys His Trp Gly Val Arg Leu Pro Ser Gly Val Trp Phe Glu Met Ala				
245	250	255		
Asp Lys Asp Leu Phe Ala Ala Ala Arg Phe Pro Glu Cys Pro Glu Gly				
260	265	270		
Ser Ser Ile Ser Ala Pro Ser Gln Thr Ser Val Asp Val Ser Leu Ile				
275	280	285		
Gln Asp Val Glu Arg Ile Leu Asp Tyr Ser Leu Cys Gln Glu Thr Trp				
290	295	300		
Ser Lys Ile Arg Ala Gly Leu Pro Ile Ser Pro Val Asp Leu Ser Tyr				
305	310	315		320
Leu Ala Pro Lys Asn Pro Gly Thr Gly Pro Ala Phe Thr Ile Ile Asn				
325	330	335		
Gly Thr Leu Lys Tyr Phe Glu Thr Arg Tyr Ile Arg Val Asp Ile Ala				
340	345	350		
Ala Pro Ile Leu Ser Arg Met Val Gly Met Ile Ser Gly Thr Thr Thr				
355	360	365		
Glu Arg Glu Leu Trp Asp Asp Trp Ala Pro Tyr Glu Asp Val Glu Ile				
370	375	380		
Gly Pro Asn Gly Val Leu Arg Thr Ser Ser Gly Tyr Lys Phe Pro Leu				
385	390	395		400
Tyr Met Ile Gly His Gly Met Leu Asp Ser Asp Leu His Leu Ser Ser				
405	410	415		
Lys Ala Gln Val Phe Glu His Pro His Ile Gln Asp Ala Xaa Ala Gln				
420	425	430		
Leu Pro Asp Asp Glu Thr Leu Phe Phe Gly Asp Thr Gly Leu Ser Lys				

435

440

445

Asn Pro Ile Glu Phe Val Glu Gly Trp Phe Ser Ser Trp Lys Ser Ser  
 450 455 460

Ile Ala Ser Phe Phe Phe Ile Ile Gly Leu Ile Ile Gly Leu Phe Leu  
 465 470 475 480

Val Leu Arg Val Gly Ile Tyr Leu Cys Ile Lys Leu Lys His Thr Lys  
 485 490 495

Lys Arg Gln Ile Tyr Thr Asp Ile Glu Met Asn Arg Leu Gly Lys  
 500 505 510

&lt;210&gt; 45

&lt;211&gt; 465

&lt;212&gt; PRT

&lt;213&gt; Vesicular stomatitis virus

&lt;400&gt; 45

Met Lys Cys Leu Leu Tyr Leu Ala Phe Leu Phe Ile Gly Val Asn Cys  
 1 5 10 15

Lys Phe Thr Ile Val Phe Pro Tyr Asn Gln Lys Gly Asn Trp Lys Asn  
 20 25 30

Val Pro Ser Asn Tyr His Tyr Cys Pro Ser Ser Ser Asp Leu Asn Trp  
 35 40 45

His Asn Asp Leu Ile Gly Thr Ala Leu Gln Val Lys Met Pro Lys Ser  
 50 55 60

His Lys Ala Ile Gln Ala Asp Gly Trp Met Cys His Ala Ser Lys Trp  
 65 70 75 80

Val Thr Thr Cys Asp Phe Arg Trp Tyr Gly Pro Lys Tyr Ile Thr His  
 85 90 95

Ser Ile Arg Ser Phe Thr Pro Ser Val Glu Gln Cys Lys Glu Ser Ile  
 100 105 110

Glu Gln Thr Lys Gln Gly Thr Trp Leu Asn Pro Gly Phe Pro Pro Gln  
 115 120 125

Ser Cys Gly Tyr Ala Thr Val Thr Asp Ala Glu Ala Ala Ile Val Gln  
 130 135 140

Val Thr Pro His His Val Leu Val Asp Glu Tyr Thr Gly Glu Trp Val  
 145 150 155 160

Asp Ser Gln Phe Ile Asn Gly Lys Cys Ser Asn Asp Ile Cys Pro Thr  
 165 170 175

Val His Asn Ser Thr Thr Trp His Ser Asp Tyr Lys Val Lys Gly Leu  
 180 185 190



Cys Asp Ser Asn Leu Ile Ser Met Asp Ile Thr Phe Phe Ser Glu Asp  
 195 200 205  
 Gly Glu Leu Ser Ser Leu Gly Lys Glu Gly Thr Gly Phe Arg Ser Asn  
 210 215 220  
 Tyr Phe Ala Tyr Glu Thr Gly Asp Lys Ala Cys Lys Met Gln Tyr Cys  
 225 230 235 240  
 Lys Arg Trp Gly Val Arg Leu Pro Ser Gly Val Trp Phe Gly Met Ala  
 245 250 255  
 Asp Lys Asp Leu Phe Ala Ala Ala Arg Phe Pro Glu Cys Pro Glu Gly  
 260 265 270  
 Ser Ser Ile Ser Ala Pro Ser Gln Thr Ser Val Asp Val Ser Leu Ile  
 275 280 285  
 Gln Asp Val Glu Arg Ile Tyr Phe Glu Thr Arg Tyr Ile Arg Val Asp  
 290 295 300  
 Ile Ala Ala Pro Ile Leu Ser Arg Met Val Gly Met Ile Ser Gly Thr  
 305 310 315 320  
 Thr Thr Glu Arg Glu Leu Trp Asp Asp Trp Ala Pro Tyr Glu Asp Val  
 325 330 335  
 Glu Ile Gly Pro Asn Gly Val Leu Arg Thr Ser Ser Gly Tyr Lys Phe  
 340 345 350  
 Pro Leu Tyr Met Ile Gly His Gly Met Leu Asp Ser Asp Leu His Leu  
 355 360 365  
 Ser Ser Lys Ala Gln Val Phe Glu His Pro His Ile Gln Asp Ala Ala  
 370 375 380  
 Ser Gln Leu Pro Asp Asp Glu Thr Leu Phe Phe Gly Asp Thr Gly Leu  
 385 390 395 400  
 Ser Lys Asn Pro Ile Glu Phe Val Glu Gly Trp Phe Ser Ser Trp Lys  
 405 410 415  
 Ser Ser Ile Ala Ser Phe Phe Phe Ile Ile Gly Leu Ile Ile Gly Leu  
 420 425 430  
 Phe Leu Val Leu Arg Val Gly Ile Tyr Leu Cys Ile Lys Leu Lys His  
 435 440 445  
 Thr Lys Lys Arg Gln Ile Tyr Thr Asp Ile Glu Met Asn Arg Leu Gly  
 450 455 460  
 Lys  
 465

<210> 46

<211> 6330

<212> DNA

<213> Vesicular stomatitis virus

<400> 46

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<210> 47

<211> 5327

<212> DNA

<213> Vesicular stomatitis virus

<400> 47

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<211> 348

<212> DNA

<213> Vesicular stomatitis virus

<400> 48

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<212> DNA

<213> Vesicular stomatitis virus

<220>

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<212> PRT  
<213> Vesicular stomatitis virus

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Tyr Leu Asn His Ala Asp Tyr Asn Leu Asn Ser Pro Leu Ile Ser Asp 45  
35 40  
Asp Ile Asp Asn Leu Ile Arg Lys Phe Asn Ser Leu Pro Ile Pro Ser 60  
50 55  
Met Trp Asp Ser Lys Asn Trp Asp Gly Val Leu Glu Met Leu Thr Ser 80  
65 70 75  
Cys Gln Ala Asn Pro Ile Ser Thr Ser Gln Met His Lys Trp Met Gly 95  
85 90  
Ser Trp Leu Met Ser Asp Asn His Asp Ala Ser Gln Gly Tyr Ser Phe 110  
100 105  
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115 120  
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Ser Glu Gln Asp Ile Phe Ser Leu Leu Asn Ile Tyr Arg Ile Gly Asp 270  
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Lys	Ile	Val	Glu	Arg	Gln	Gly	Asn	Phe	Ser	Tyr	Asp	Leu	Ile	Lys	Met	275	280	285
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Gly	Ser	Phe	Arg	His	Trp	Gly	His	Pro	Phe	Ile	Asp	Tyr	Tyr	Thr	Gly	355	360	365
Leu	Glu	Lys	Leu	His	Ser	Gln	Val	Thr	Met	Lys	Lys	Asp	Ile	Asp	Val	370	375	380
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Pro	His	Asp	His	Pro	Phe	Lys	Ser	His	Val	Lys	Glu	Asn	Thr	Trp	Pro	420	425	430
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Val	Arg	Met	Asn	Pro	Asn	Thr	Pro	Ile	Pro	Ser	Lys	Lys	Val	Leu	Gln	485	490	495
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Ser	Trp	Lys	Leu	Arg	Glu	Tyr	Phe	Val	Ile	Thr	Glu	Tyr	Leu	Ile	Lys	545	550	555
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 Tyr Gln Gln Cys Leu Ala Val Ile Gln Gln Ser Phe Pro Ile Arg Trp  
 1985 1990 1995 2000  
 Glu Ala Val Ser Val Lys Gly Gly Tyr Lys Gln Lys Trp Ser Thr Arg  
 2005 2010 2015  
 Gly Asp Gly Leu Pro Lys Asp Thr Arg Thr Ser Asp Ser Leu Ala Pro  
 2020 2025 2030  
 Ile Gly Asn Trp Ile Arg Ser Leu Glu Leu Val Arg Asn Gln Val Arg  
 2035 2040 2045  
 Leu Asn Pro Phe Asn Glu Ile Leu Phe Asn Gln Leu Cys Arg Thr Val  
 2050 2055 2060  
 Asp Asn His Leu Lys Trp Ser Asn Leu Arg Arg Asn Thr Gly Met Ile  
 2065 2070 2075 2080  
 Glu Trp Ile Asn Arg Arg Ile Ser Lys Glu Asp Arg Ser Ile Leu Met  
 2085 2090 2095

Leu Lys Ser Asp Leu His Glu Glu Asn Ser Trp Arg Asp  
2100 2105

<210> 51

<211> 1753

<212> PRT

<213> Vesicular stomatitis virus

<220>

<221> MOD\_RES

<222> (1)..(1753)

<223> "Xaa" represents any, other or unknown amino acid

<400> 51

His Trp Gly His Pro Phe Ile Asp Tyr Tyr Ala Gly Leu Glu Lys Leu  
1 5 10 15

His Ser Gln Val Thr Xaa Lys Lys Asp Ile Asp Val Ser Tyr Ala Lys  
20 25 30

Ala Leu Ala Ser Asp Leu Ala Arg Ile Val Leu Phe Gln Gln Phe Asn  
35 40 45

Asp His Xaa Lys Trp Phe Val Asn Gly Asp Leu Leu Pro His Asp His  
50 55 60

Pro Phe Lys Ser His Val Lys Glu Asn Thr Trp Pro Thr Ala Ala Gln  
65 70 75 80

Val Gln Asp Phe Gly Asp Lys Trp His Glu Leu Pro Leu Ile Lys Cys  
85 90 95

Phe Glu Ile Pro Asp Leu Leu Asp Pro Ser Ile Ile Tyr Ser Asp Lys  
100 105 110

Ser His Ser Met Asn Arg Ser Glu Val Leu Lys His Val Arg Met Asn  
115 120 125

Pro Asn Thr Pro Ile Pro Ser Lys Lys Val Leu Gln Thr Met Leu Asp  
130 135 140

Thr Lys Ala Thr Asn Trp Lys Glu Phe Leu Lys Glu Ile Asp Glu Lys  
145 150 155 160

Gly Leu Asp Asp Asp Asp Leu Ile Ile Gly Leu Lys Gly Lys Glu Arg  
165 170 175

Glu Leu Lys Leu Ala Gly Arg Phe Phe Ser Leu Met Ser Trp Lys Leu  
180 185 190

Arg Glu Tyr Phe Val Ile Thr Glu Tyr Leu Ile Lys Thr His Phe Val  
195 200 205

Pro Met Phe Lys Gly Leu Thr Met Ala Asp Asp Leu Thr Ala Val Ile  
210 215 220

Lys Lys Met Leu Asp Ser Ser Ser Gly Gln Gly Leu Lys Ser Tyr Glu 240  
 225 230 235  
 Ala Ile Cys Ile Ala Asn His Ile Asp Tyr Glu Lys Trp Asn Asn His 255  
 245 250  
 Gln Arg Lys Leu Ser Asn Gly Pro Val Phe Arg Val Met Gly Gln Phe 270  
 260 265  
 Leu Gly Tyr Pro Ser Leu Ile Glu Arg Thr His Glu Phe Phe Glu Lys 285  
 275 280  
 Ser Leu Ile Tyr Tyr Asn Gly Arg Pro Asp Leu Met Arg Val His Asn 300  
 290 295  
 Asn Thr Leu Ile Asn Ser Thr Ser Gln Arg Val Cys Trp Gln Gly Gln 320  
 305 310 315  
 Glu Gly Gly Leu Glu Gly Leu Arg Gln Lys Gly Trp Ser Ile Leu Asn 335  
 325 330  
 Leu Leu Val Ile Gln Arg Glu Ala Lys Ile Arg Asn Thr Ala Val Lys 350  
 340 345  
 Val Leu Ala Gln Gly Asp Asn Gln Val Ile Cys Thr Gln Tyr Lys Thr 365  
 355 360  
 Lys Lys Ser Arg Asn Val Val Glu Leu Gln Gly Ala Leu Asn Gln Met 380  
 370 375  
 Val Ser Asn Asn Glu Lys Ile Met Thr Ala Ile Lys Ile Gly Thr Gly 400  
 385 390 395  
 Lys Leu Gly Leu Leu Ile Asn Asp Asp Glu Thr Met Gln Ser Ala Asp 415  
 405 410  
 Tyr Leu Asn Tyr Gly Lys Ile Pro Ile Phe Arg Gly Val Ile Arg Gly 430  
 420 425  
 Leu Glu Thr Lys Arg Trp Ser Arg Val Thr Cys Val Thr Asn Asp Gln 445  
 435 440  
 Ile Pro Thr Cys Ala Asn Ile Met Ser Ser Val Ser Thr Asn Ala Leu 460  
 450 455  
 Thr Val Ala His Phe Ala Glu Asn Pro Ile Asn Ala Met Ile Gln Tyr 480  
 465 470 475  
 Asn Tyr Phe Gly Thr Phe Ala Arg Leu Leu Leu Met Met His Asp Pro 495  
 485 490  
 Ala Leu Arg Gln Ser Leu Tyr Glu Val Gln Asp Lys Ile Pro Gly Leu 510  
 500 505  
 His Ser Ser Thr Phe Lys Tyr Ala Met Leu Tyr Leu Asp Pro Ser Ile 525  
 515 520



Gly 530	Gly 530	Val	Ser	Gly	Met	Ser	Leu	Ser	Arg	Phe	Leu	Ile	Arg	Ala	Phe
Pro 545	Asp	Pro	Val	Thr	Glu 550	Ser	Leu	Ser	Phe	Trp 555	Arg	Phe	Ile	His	Val 560
His	Ala	Arg	Ser	Glu 565	His	Leu	Lys	Glu	Met 570	Ser	Ala	Val	Phe	Gly 575	Asn
Pro	Glu	Ile	Ala 580	Lys	Phe	Arg	Ile	Thr 585	His	Ile	Asp	Lys	Leu 590	Val	Glu
Asp	Pro	Thr 595	Ser	Leu	Asn	Ile	Ala 600	Met	Gly	Met	Ser	Pro 605	Ala	Asn	Leu
Leu	Lys 610	Thr	Glu	Val	Lys	Lys 615	Cys	Leu	Ile	Glu	Ser 620	Arg	Gln	Thr	Ile
Arg 625	Asn	Gln	Val	Ile	Lys 630	Asp	Ala	Thr	Ile	Tyr 635	Leu	Tyr	His	Glu	Glu 640
Asp	Arg	Leu	Arg	Ser 645	Phe	Leu	Trp	Ser	Ile 650	Asn	Pro	Leu	Phe	Pro 655	Arg
Phe	Leu	Ser	Glu 660	Phe	Lys	Ser	Gly	Thr 665	Phe	Leu	Gly	Val	Ala 670	Asp	Gly
Leu	Ile 675	Ser	Leu	Phe	Gln	Asn	Ser 680	Arg	Thr	Ile	Arg 685	Asn	Ser	Phe	Lys
Lys 690	Lys	Tyr	His	Arg	Glu	Leu 695	Asp	Asp	Leu	Ile	Val 700	Arg	Ser	Glu	Val
Ser 705	Ser	Leu	Thr	His	Leu 710	Gly	Lys	Leu	His	Leu 715	Arg	Arg	Gly	Ser	Cys 720
Lys	Met	Trp	Thr	Cys 725	Ser	Ala	Thr	His	Ala 730	Asp	Thr	Leu	Arg	Tyr 735	Lys
Ser	Trp	Gly	Arg 740	Thr	Val	Ile	Gly	Thr 745	Thr	Val	Pro	His 750	Pro	Leu	Glu
Met	Leu 755	Gly	Pro	Gln	His	Arg	Lys 760	Glu	Thr	Pro	Cys 765	Ala	Pro	Cys	Asn
Thr 770	Ser	Gly	Phe	Asn	Tyr	Val 775	Ser	Val	His	Cys 780	Pro	Asp	Gly	Ile	His
Asp 785	Val	Phe	Ser	Ser	Arg 790	Gly	Pro	Leu	Pro	Ala 795	Tyr	Leu	Gly	Ser	Lys 800
Thr	Ser	Glu	Ser	Thr 805	Ser	Ile	Leu	Gln	Pro 810	Trp	Glu	Arg	Glu	Ser 815	Lys
Val	Pro	Leu	Ile 820	Lys	Arg	Ala	Thr	Arg 825	Leu	Arg	Asp	Ala	Ile 830	Ser	Trp

Phe Val Glu Pro Asp Ser Lys Leu Ala Met Thr Ile Leu Ser Asn Ile  
835 840 845

His Ser Leu Thr Gly Glu Glu Trp Thr Lys Arg Gln His Gly Phe Lys  
850 855 860

Arg Thr Gly Ser Ala Leu His Arg Phe Ser Thr Ser Arg Met Ser His  
865 870 875 880

Gly Gly Phe Ala Ser Gln Ser Thr Ala Ala Leu Thr Arg Leu Met Ala  
885 890 895

Thr Thr Asp Thr Met Arg Asp Leu Gly Asp Gln Asn Phe Asp Phe Leu  
900 905 910

Phe Gln Ala Thr Leu Leu Tyr Ala Gln Ile Thr Thr Thr Val Ala Arg  
915 920 925

Asp Gly Trp Ile Thr Ser Cys Thr Asp His Tyr His Ile Ala Cys Lys  
930 935 940

Ser Cys Leu Arg Pro Ile Glu Glu Ile Thr Leu Asp Ser Ser Met Asp  
945 950 955 960

Tyr Thr Pro Pro Asp Val Ser His Val Leu Lys Thr Trp Arg Asn Gly  
965 970 975

Glu Gly Ser Trp Gly Gln Glu Ile Lys Gln Ile Tyr Pro Leu Glu Gly  
980 985 990

Asn Trp Lys Asn Leu Ala Pro Ala Glu Gln Ser Tyr Gln Val Gly Arg  
995 1000 1005

Cys Ile Gly Phe Leu Tyr Gly Asp Leu Ala Tyr Arg Lys Ser Thr His  
1010 1015 1020

Ala Glu Asp Ser Ser Leu Phe Pro Leu Ser Ile Gln Gly Arg Ile Arg  
1025 1030 1035 1040

Gly Arg Gly Phe Leu Lys Gly Leu Leu Asp Gly Leu Met Arg Ala Ser  
1045 1050 1055

Cys Cys Gln Val Ile His Arg Arg Ser Leu Ala His Leu Lys Arg Pro  
1060 1065 1070

Ala Asn Ala Val Tyr Gly Gly Leu Ile Tyr Leu Ile Asp Lys Leu Ser  
1075 1080 1085

Val Ser Pro Pro Phe Leu Ser Leu Thr Arg Ser Gly Pro Ile Arg Asp  
1090 1095 1100

Glu Leu Glu Thr Ile Pro His Lys Ile Pro Thr Ser Tyr Pro Thr Ser  
1105 1110 1115 1120

Asn Arg Asp Met Gly Val Ile Val Arg Asn Tyr Phe Lys Tyr Gln Cys  
1125 1130 1135

Arg Leu Ile Glu Lys Gly Lys Tyr Arg Ser His Tyr Ser Gln Leu Trp  
 1140 1145 1150  
 Leu Phe Ser Asp Val Leu Ser Ile Asp Phe Ile Gly Pro Phe Ser Ile  
 1155 1160 1165  
 Ser Thr Thr Leu Leu Gln Ile Leu Tyr Lys Pro Phe Leu Ser Gly Lys  
 1170 1175 1180  
 Asp Lys Asn Glu Leu Arg Glu Leu Ala Asn Leu Ser Ser Leu Leu Arg  
 1185 1190 1195 1200  
 Ser Gly Glu Gly Trp Glu Asp Ile His Val Lys Phe Phe Thr Lys Asp  
 1205 1210 1215  
 Ile Leu Leu Cys Pro Glu Glu Ile Arg His Ala Cys Lys Phe Gly Ile  
 1220 1225 1230  
 Ala Lys Asp Asn Asn Lys Asp Met Ser Tyr Pro Pro Trp Gly Arg Glu  
 1235 1240 1245  
 Ser Arg Gly Thr Ile Thr Thr Ile Pro Val Tyr Tyr Thr Thr Thr Pro  
 1250 1255 1260  
 Tyr Pro Lys Met Leu Glu Met Pro Pro Arg Ile Gln Asn Pro Leu Leu  
 1265 1270 1275 1280  
 Ser Gly Ile Arg Leu Gly Gln Leu Pro Thr Gly Ala His Tyr Lys Ile  
 1285 1290 1295  
 Arg Ser Ile Leu His Gly Met Gly Ile His Tyr Arg Asp Phe Leu Ser  
 1300 1305 1310  
 Cys Gly Asp Gly Ser Gly Gly Met Thr Ala Ala Leu Leu Arg Glu Asn  
 1315 1320 1325  
 Val His Ser Arg Gly Ile Phe Asn Ser Leu Leu Glu Leu Ser Gly Ser  
 1330 1335 1340  
 Val Met Arg Gly Ala Ser Pro Glu Pro Pro Ser Ala Leu Glu Thr Leu  
 1345 1350 1355 1360  
 Gly Gly Asp Lys Ser Arg Cys Val Asn Gly Glu Thr Cys Trp Glu Tyr  
 1365 1370 1375  
 Pro Ser Asp Leu Cys Asp Pro Arg Thr Trp Asp Tyr Phe Leu Arg Leu  
 1380 1385 1390  
 Lys Ala Gly Leu Gly Leu Gln Ile Asp Leu Ile Val Met Asp Met Glu  
 1395 1400 1405  
 Val Arg Asp Ser Ser Thr Ser Leu Lys Ile Glu Thr Asn Val Arg Asn  
 1410 1415 1420  
 Tyr Val His Arg Ile Leu Asp Glu Gln Gly Val Leu Ile Tyr Lys Thr  
 1425 1430 1435 1440

Tyr Gly Thr Tyr Ile Cys Glu Ser Glu Lys Asn Ala Val Thr Ile Leu  
1445 1450 1455

Gly Pro Met Phe Lys Thr Val Asp Leu Val Gln Thr Glu Phe Ser Ser  
1460 1465 1470

Ser Gln Thr Ser Glu Val Tyr Met Val Cys Lys Gly Leu Lys Lys Leu  
1475 1480 1485

Ile Asp Glu Pro Asn Pro Asp Trp Ser Ser Ile Asn Glu Ser Trp Lys  
1490 1495 1500

Asn Leu Tyr Ala Phe Gln Ser Ser Glu Gln Glu Phe Ala Arg Ala Lys  
1505 1510 1515 1520

Lys Val Ser Thr Tyr Phe Thr Leu Thr Gly Ile Pro Ser Gln Phe Ile  
1525 1530 1535

Pro Asp Pro Phe Val Asn Ile Glu Thr Met Leu Gln Ile Phe Gly Val  
1540 1545 1550

Pro Thr Gly Val Ser His Ala Ala Ala Leu Lys Ser Ser Asp Arg Pro  
1555 1560 1565

Ala Asp Leu Leu Thr Ile Ser Leu Phe Tyr Met Ala Ile Ile Ser Tyr  
1570 1575 1580

Tyr Asn Ile Asn His Ile Arg Val Gly Pro Ile Pro Pro Asn Pro Pro  
1585 1590 1595 1600

Ser Asp Gly Ile Ala Gln Asn Val Gly Ile Ala Ile Thr Gly Ile Ser  
1605 1610 1615

Phe Trp Leu Ser Leu Met Glu Lys Asp Ile Pro Leu Tyr Gln Gln Cys  
1620 1625 1630

Leu Ala Val Ile Gln Gln Ser Phe Pro Ile Arg Trp Glu Ala Val Ser  
1635 1640 1645

Val Lys Gly Gly Tyr Lys Gln Lys Trp Ser Thr Arg Gly Asp Gly Leu  
1650 1655 1660

Pro Lys Asp Thr Arg Ile Ser Asp Ser Leu Ala Pro Ile Gly Asn Trp  
1665 1670 1675 1680

Ile Arg Ser Leu Glu Leu Val Arg Asn Gln Val Arg Leu Asn Pro Phe  
1685 1690 1695

Asn Glu Ile Leu Phe Asn Gln Leu Cys Arg Thr Val Asp Asn His Leu  
1700 1705 1710

Lys Trp Ser Asn Leu Arg Lys Asn Thr Gly Met Ile Glu Trp Ile Asn  
1715 1720 1725

Arg Arg Ile Ser Lys Glu Asp Arg Ser Ile Leu Met Leu Lys Ser Asp  
1730 1735 1740

Leu His Glu Glu Asn Ser Trp Arg Asp  
1745 1750

<210> 52

<211> 2109

<212> PRT

<213> Vesicular stomatitis virus

<220>

<221> MOD\_RES

<222> (1)..(2109)

<223> "Xaa" represents any, other or unknown amino acid

<400> 52

Met Glu Val His Asp Phe Glu Thr Asp Glu Phe Asn Asp Phe Asn Glu  
1 5 10 15

Asp Asp Tyr Ala Thr Arg Glu Phe Leu Asn Pro Asp Glu Arg Met Thr  
20 25 30

Tyr Leu Asn His Ala Asp Tyr Asn Leu Asn Ser Pro Leu Ile Ser Asp  
35 40 45

Asp Ile Asp Asn Leu Ile Arg Lys Phe Asn Ser Leu Pro Ile Pro Ser  
50 55 60

Met Trp Asp Ser Lys Asn Trp Asp Gly Val Leu Glu Met Leu Thr Ser  
65 70 75 80

Cys Gln Ala Asn Pro Ile Ser Thr Ser Gln Met His Lys Trp Met Gly  
85 90 95

Ser Trp Leu Met Ser Asp Asn His Asp Ala Ser Gln Gly Tyr Ser Phe  
100 105 110

Leu His Glu Val Asp Lys Glu Ala Glu Ile Thr Phe Asp Val Val Glu  
115 120 125

Thr Phe Ile Arg Gly Trp Gly Asn Lys Pro Ile Glu Tyr Ile Lys Lys  
130 135 140

Glu Arg Trp Thr Asp Ser Phe Lys Ile Leu Ala Tyr Leu Cys Gln Lys  
145 150 155 160

Phe Leu Asp Leu His Lys Leu Thr Leu Ile Leu Asn Ala Val Ser Glu  
165 170 175

Val Glu Leu Leu Asn Leu Ala Arg Thr Phe Lys Gly Lys Val Arg Arg  
180 185 190

Ser Ser His Gly Thr Asn Ile Cys Arg Leu Arg Val Pro Ser Leu Gly  
195 200 205

Pro Thr Phe Ile Ser Glu Gly Trp Ala Tyr Phe Lys Lys Leu Asp Ile  
210 215 220

Leu Met Asp Arg Asn Phe Leu Leu Met Val Lys Asp Val Ile Ile Gly  
 225 230 235 240  
 Arg Met Gln Thr Val Leu Ser Met Val Cys Arg Ile Asp Asn Leu Phe  
 245 250 255  
 Ser Glu Gln Asp Ile Phe Ser Leu Leu Asn Ile Tyr Arg Ile Gly Asp  
 260 265 270  
 Lys Ile Val Glu Arg Gln Gly Asn Phe Ser Tyr Asp Leu Ile Lys Met  
 275 280 285  
 Val Glu Pro Ile Cys Asn Leu Arg Leu Met Lys Leu Ala Arg Glu Ser  
 290 295 300  
 Arg Pro Leu Val Pro Gln Phe Pro His Phe Glu Asn His Ile Lys Thr  
 305 310 315 320  
 Ser Val Asp Glu Gly Ala Lys Ile Asp Arg Gly Ile Arg Phe Leu His  
 325 330 335  
 Asp Gln Ile Met Ser Val Lys Thr Val Asp Leu Thr Leu Val Ile Tyr  
 340 345 350  
 Gly Ser Phe Arg His Trp Gly His Pro Phe Ile Asp Tyr Tyr Ala Gly  
 355 360 365  
 Leu Glu Lys Leu His Ser Gln Val Thr Met Lys Lys Asp Ile Asp Val  
 370 375 380  
 Ser Tyr Ala Lys Ala Leu Ala Ser Asp Leu Ala Arg Ile Val Leu Phe  
 385 390 395 400  
 Gln Gln Phe Asn Asp His Lys Lys Trp Phe Val Asn Gly Asp Leu Leu  
 405 410 415  
 Pro His Asp His Pro Phe Lys Ser His Val Lys Glu Asn Thr Trp Pro  
 420 425 430  
 Thr Ala Ala Gln Val Gln Asp Phe Gly Asp Lys Trp His Glu Leu Pro  
 435 440 445  
 Leu Ile Lys Cys Phe Glu Ile Pro Asp Leu Leu Asp Pro Ser Ile Ile  
 450 455 460  
 Tyr Ser Asp Lys Ser His Ser Met Asn Arg Ser Glu Val Leu Lys His  
 465 470 475 480  
 Val Arg Met Asn Pro Asn Thr Pro Ile Pro Ser Lys Lys Val Leu Gln  
 485 490 495  
 Thr Met Leu Asp Thr Lys Ala Thr Asn Trp Lys Glu Phe Leu Lys Glu  
 500 505 510  
 Ile Asp Glu Lys Gly Leu Asp Asp Asp Asp Leu Ile Ile Gly Leu Lys  
 515 520 525

Gly Lys Glu Arg Glu Leu Lys Leu Ala Gly Arg Phe Phe Ser Leu Met  
 530 535 540

Ser Trp Lys Leu Arg Glu Tyr Phe Val Ile Thr Glu Tyr Leu Ile Lys  
 545 550 555 560

Thr His Phe Val Pro Met Phe Lys Gly Leu Thr Met Ala Asp Asp Leu  
 565 570 575

Thr Ala Val Ile Lys Lys Met Leu Asp Ser Ser Ser Gly Gln Gly Leu  
 580 585 590

Lys Ser Tyr Glu Ala Ile Cys Ile Ala Asn His Ile Asp Tyr Glu Lys  
 595 600 605

Trp Asn Asn His Gln Arg Lys Leu Ser Asn Gly Pro Val Phe Arg Val  
 610 615 620

Met Gly Gln Phe Leu Gly Tyr Pro Ser Leu Ile Glu Arg Thr His Glu  
 625 630 635 640

Phe Phe Glu Lys Ser Leu Ile Tyr Tyr Asn Gly Arg Pro Asp Leu Met  
 645 650 655

Arg Val His Asn Asn Thr Leu Ile Asn Ser Thr Ser Gln Arg Val Cys  
 660 665 670

Trp Gln Gly Gln Glu Gly Gly Leu Glu Gly Leu Arg Gln Lys Gly Trp  
 675 680 685

Ser Ile Leu Asn Leu Leu Val Ile Gln Arg Glu Ala Lys Ile Arg Asn  
 690 695 700

Thr Ala Val Lys Val Leu Ala Gln Gly Asp Asn Gln Val Ile Cys Thr  
 705 710 715 720

Gln Tyr Lys Thr Lys Lys Ser Arg Asn Val Val Glu Leu Gln Gly Ala  
 725 730 735

Leu Asn Gln Met Val Ser Asn Asn Glu Lys Ile Met Thr Ala Ile Lys  
 740 745 750

Ile Gly Thr Gly Lys Leu Gly Leu Leu Ile Asn Asp Asp Glu Thr Met  
 755 760 765

Gln Ser Ala Asp Tyr Leu Asn Tyr Gly Lys Ile Pro Ile Phe Arg Gly  
 770 775 780

Val Ile Arg Gly Leu Glu Thr Lys Arg Trp Ser Arg Val Thr Cys Val  
 785 790 795 800

Thr Asn Asp Gln Ile Pro Thr Cys Ala Asn Ile Met Ser Ser Val Ser  
 805 810 815

Thr Asn Ala Leu Thr Val Ala His Phe Ala Glu Asn Pro Ile Asn Ala  
 820 825 830

Met Ile Gln Tyr Asn Tyr Phe Gly Thr Phe Ala Arg Leu Leu Leu Met  
 835 840 845

Met His Asp Pro Ala Leu Arg Gln Ser Leu Tyr Glu Val Gln Asp Lys  
 850 855 860

Ile Pro Gly Leu His Ser Ser Thr Phe Lys Tyr Ala Met Leu Tyr Leu  
 865 870 875 880

Asp Pro Ser Ile Gly Gly Val Ser Gly Met Ser Leu Ser Arg Phe Leu  
 885 890 895

Ile Arg Ala Phe Pro Asp Pro Val Thr Glu Ser Leu Ser Phe Trp Arg  
 900 905 910

Phe Ile His Val His Ala Arg Ser Glu His Leu Lys Glu Met Ser Ala  
 915 920 925

Val Phe Gly Asn Pro Glu Ile Ala Lys Phe Arg Ile Thr His Ile Asp  
 930 935 940

Lys Leu Val Glu Asp Pro Thr Ser Leu Asn Ile Ala Met Gly Met Ser  
 945 950 955 960

Pro Ala Asn Leu Leu Lys Thr Glu Val Lys Lys Cys Leu Ile Glu Ser  
 965 970 975

Arg Gln Thr Ile Arg Asn Gln Val Ile Lys Asp Ala Thr Ile Tyr Leu  
 980 985 990

Tyr His Glu Glu Asp Arg Leu Arg Ser Phe Leu Trp Ser Ile Asn Pro  
 995 1000 1005

Leu Phe Pro Arg Phe Leu Ser Glu Phe Lys Ser Gly Thr Phe Leu Gly  
 1010 1015 1020

Val Ala Asp Gly Leu Ile Ser Leu Phe Gln Asn Ser Arg Thr Ile Arg  
 1025 1030 1035 1040

Asn Ser Phe Lys Lys Lys Tyr His Arg Glu Leu Asp Asp Leu Ile Val  
 1045 1050 1055

Arg Ser Glu Val Ser Ser Leu Thr His Leu Gly Lys Leu His Leu Arg  
 1060 1065 1070

Arg Gly Ser Cys Lys Met Trp Thr Cys Ser Ala Thr His Ala Asp Thr  
 1075 1080 1085

Leu Arg Tyr Lys Ser Trp Gly Arg Thr Val Ile Gly Thr Thr Val Pro  
 1090 1095 1100

His Pro Leu Glu Met Leu Gly Pro Gln His Arg Lys Glu Thr Pro Cys  
 1105 1110 1115 1120

Ala Pro Cys Asn Thr Ser Gly Phe Asn Tyr Val Ser Val His Cys Pro  
 1125 1130 1135



Asp Gly Ile His Asp Val Phe Ser Ser Arg Gly Pro Leu Pro Ala Tyr  
1140 1145 1150

Leu Gly Ser Lys Thr Ser Glu Ser Thr Ser Ile Leu Gln Pro Trp Glu  
1155 1160 1165

Arg Glu Ser Lys Val Pro Leu Ile Lys Arg Ala Thr Arg Leu Arg Asp  
1170 1175 1180

Ala Ile Ser Trp Phe Val Glu Pro Asp Ser Lys Leu Ala Met Thr Ile  
1185 1190 1195 1200

Leu Ser Asn Ile His Ser Leu Thr Gly Glu Glu Trp Thr Lys Arg Gln  
1205 1210 1215

His Gly Phe Lys Arg Thr Gly Ser Ala Leu His Arg Phe Ser Thr Ser  
1220 1225 1230

Arg Met Ser His Gly Gly Phe Ala Ser Gln Ser Thr Ala Ala Leu Thr  
1235 1240 1245

Arg Leu Met Ala Thr Thr Asp Thr Met Arg Asp Leu Gly Asp Gln Asn  
1250 1255 1260

Phe Asp Phe Leu Phe Xaa Ala Thr Leu Leu Tyr Ala Xaa Ile Thr Thr  
1265 1270 1275 1280

Thr Val Ala Arg Asp Gly Trp Ile Thr Ser Cys Thr Asp His Tyr His  
1285 1290 1295

Ile Ala Cys Lys Ser Cys Leu Arg Pro Ile Glu Glu Ile Thr Leu Asp  
1300 1305 1310

Ser Ser Met Asp Tyr Thr Pro Pro Asp Val Ser His Val Leu Lys Thr  
1315 1320 1325

Trp Arg Asn Gly Glu Gly Ser Trp Gly Gln Glu Ile Lys Gln Ile Tyr  
1330 1335 1340

Pro Leu Glu Gly Asn Trp Lys Asn Leu Ala Pro Ala Glu Gln Ser Tyr  
1345 1350 1355 1360

Gln Val Gly Arg Cys Ile Gly Phe Leu Tyr Gly Asp Leu Ala Tyr Arg  
1365 1370 1375

Lys Ser Thr His Ala Glu Asp Ser Ser Leu Phe Pro Leu Ser Ile Gln  
1380 1385 1390

Gly Arg Ile Arg Gly Arg Gly Phe Leu Lys Gly Leu Leu Asp Gly Leu  
1395 1400 1405

Met Arg Ala Ser Cys Cys Gln Val Ile His Arg Arg Ser Leu Ala His  
1410 1415 1420

Leu Lys Arg Pro Ala Asn Ala Val Tyr Gly Gly Leu Ile Tyr Leu Ile  
1425 1430 1435 1440

Asp Lys Leu Ser Val Ser Pro Pro Phe Leu Ser Leu Thr Arg Ser Gly  
 1445 1450 1455  
 Pro Ile Arg Asp Glu Leu Glu Thr Ile Pro His Lys Ile Pro Thr Ser  
 1460 1465 1470  
 Tyr Pro Thr Ser Asn Arg Asp Met Gly Val Ile Val Arg Asn Tyr Phe  
 1475 1480 1485  
 Lys Tyr Gln Cys Arg Leu Ile Glu Lys Gly Lys Tyr Arg Ser His Tyr  
 1490 1495 1500  
 Ser Gln Leu Trp Leu Phe Ser Asp Val Leu Ser Ile Asp Phe Ile Gly  
 1505 1510 1515 1520  
 Pro Phe Ser Ile Ser Thr Thr Leu Leu Gln Ile Leu Tyr Lys Pro Phe  
 1525 1530 1535  
 Leu Ser Gly Lys Asp Lys Asn Glu Leu Arg Glu Leu Ala Asn Leu Ser  
 1540 1545 1550  
 Ser Leu Leu Arg Ser Gly Glu Gly Trp Glu Asp Ile His Val Lys Phe  
 1555 1560 1565  
 Phe Thr Lys Asp Ile Leu Leu Cys Pro Glu Glu Ile Arg His Ala Cys  
 1570 1575 1580  
 Lys Phe Gly Ile Ala Lys Asp Asn Asn Lys Asp Met Ser Tyr Pro Pro  
 1585 1590 1595 1600  
 Trp Gly Arg Glu Ser Arg Gly Thr Ile Thr Thr Ile Pro Val Tyr Tyr  
 1605 1610 1615  
 Thr Thr Thr Pro Tyr Pro Lys Met Leu Glu Met Pro Pro Arg Ile Gln  
 1620 1625 1630  
 Asn Pro Leu Leu Ser Gly Ile Arg Leu Gly Gln Leu Pro Thr Gly Ala  
 1635 1640 1645  
 His Tyr Lys Ile Arg Ser Ile Leu His Gly Met Gly Ile His Tyr Arg  
 1650 1655 1660  
 Asp Phe Leu Ser Cys Gly Asp Gly Ser Gly Gly Met Thr Ala Ala Leu  
 1665 1670 1675 1680  
 Leu Arg Glu Asn Val His Ser Arg Gly Ile Phe Asn Ser Leu Leu Glu  
 1685 1690 1695  
 Leu Ser Gly Ser Val Met Arg Gly Ala Ser Pro Glu Pro Pro Ser Ala  
 1700 1705 1710  
 Leu Glu Thr Leu Gly Gly Asp Lys Ser Arg Cys Val Asn Gly Glu Thr  
 1715 1720 1725  
 Cys Trp Glu Tyr Pro Ser Asp Leu Cys Asp Pro Arg Thr Trp Asp Tyr  
 1730 1735 1740

Phe Leu Arg Leu Lys Ala Gly Leu Gly Leu Gln Ile Asp Leu Ile Val  
1745 1750 1755 1760  
Met Asp Met Glu Val Arg Asp Ser Ser Thr Ser Leu Lys Ile Glu Thr  
1765 1770 1775  
Asn Val Arg Asn Tyr Val His Arg Ile Leu Asp Glu Gln Gly Val Leu  
1780 1785 1790  
Ile Tyr Lys Thr Tyr Gly Thr Tyr Ile Cys Glu Ser Glu Lys Asn Ala  
1795 1800 1805  
Val Thr Ile Leu Gly Pro Met Phe Lys Thr Val Asp Leu Val Gln Thr  
1810 1815 1820  
Glu Phe Ser Ser Ser Gln Thr Ser Glu Val Tyr Met Val Cys Lys Gly  
1825 1830 1835 1840  
Leu Lys Lys Leu Ile Asp Glu Pro Asn Pro Asp Trp Ser Ser Ile Asn  
1845 1850 1855  
Glu Ser Trp Lys Asn Leu Tyr Ala Phe Gln Ser Ser Glu Gln Glu Phe  
1860 1865 1870  
Ala Arg Ala Lys Lys Val Ser Thr Tyr Phe Thr Leu Thr Gly Ile Pro  
1875 1880 1885  
Ser Gln Phe Ile Pro Asp Pro Phe Val Asn Ile Glu Thr Met Leu Gln  
1890 1895 1900  
Ile Phe Gly Val Pro Thr Gly Val Ser His Ala Ala Ala Leu Lys Ser  
1905 1910 1915 1920  
Ser Asp Arg Pro Ala Asp Leu Leu Thr Ile Ser Leu Phe Tyr Met Ala  
1925 1930 1935  
Ile Ile Ser Tyr Tyr Asn Ile Asn His Ile Arg Val Gly Pro Ile Pro  
1940 1945 1950  
Pro Asn Pro Pro Ser Asp Gly Ile Ala Gln Asn Val Gly Ile Ala Ile  
1955 1960 1965  
Thr Gly Ile Ser Phe Trp Leu Ser Leu Met Glu Lys Asp Ile Pro Leu  
1970 1975 1980  
Tyr Gln Gln Cys Leu Ala Val Ile Gln Gln Ser Phe Pro Ile Arg Trp  
1985 1990 1995 2000  
Glu Ala Val Ser Val Lys Gly Gly Tyr Lys Gln Lys Trp Ser Thr Arg  
2005 2010 2015  
Gly Asp Gly Leu Pro Lys Asp Thr Arg Ile Ser Asp Ser Leu Ala Pro  
2020 2025 2030  
Ile Gly Asn Trp Ile Arg Ser Leu Glu Leu Val Arg Asn Gln Val Arg  
2035 2040 2045

Leu Asn Pro Phe Asn Glu Ile Leu Phe Asn Gln Leu Cys Arg Thr Val  
2050 2055 2060

Asp Asn His Leu Lys Trp Ser Asn Leu Arg Lys Asn Thr Gly Met Ile  
2065 2070 2075 2080

Glu Trp Ile Asn Arg Arg Ile Ser Lys Glu Asp Arg Ser Ile Leu Met  
2085 2090 2095

Leu Lys Ser Asp Leu His Glu Glu Asn Ser Trp Arg Asp  
2100 2105